FLIGHT

The AIRCRAFT ENGINEER & AIRSHIPS

First Aero Weekly in the World

Founder and Editor: STANLEY SPOONER

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CONTENTS

DIARY OF FORTHCOMING EVENTS.

Club Secretaries and others desirous of announcing the date of important fixtures are invited to send particulars for inclusion in the following list:

April 7 ...	Lecture by Mr. J. L. Cope, "Aerial Survey in the Antarctic," at Central Hall, Westminster, 8 p.m.
April 18 to May 2	Seaplane Competition at Monaco
May 22 and 23	Aviation Competition at Juvisy in connection with Fêtes de Paris
June 1 ...	Air Ministry Competition (Small Type Aeroplanes), Martlesham Heath
July ...	S.B.A.C. International Aero Exhibition at Olympia
July (mid.)	Seaplane Contests at Antwerp
Aug. 1 ...	Air Ministry Competition (Seaplanes), Felixstowe
Aug. (end of)	Schneider International Race, Venice.
Sept. 1 ...	Air Ministry Competition (Large Type Aeroplanes), Martlesham Heath
Sept. ...	International aviation week (with competitions) at Brescia, Italy
Sept. (end of)	Gordon-Bennett Aviation Cup, France.

EDITORIAL COMMENT

The African Adventure

WITH the crashing of Col. van Ryneveld's machine when taking off at Bulawayo—only 1,300 miles from its goal—the last of the attempts to cross Africa from Cairo to the Cape has, for the time being, come to an end. It is possible that Col. van Ryneveld may still reach Cape Town by air, but in a machine which is being sent to him from South Africa, so that in the meantime the attempt to make a single-machine journey from England to the Cape has definitely failed. What happened to cause this unfortunate accident we do not actually know yet; but in the case of *The Times* adventure the failure encountered was mainly due to engine trouble. Certainly there is no better engine made than those with which Dr. Chalmers Mitchell and his companions essayed their end-to-end flight, and the repeated failures of the best there is would seem to teach that we have not gone far enough in engine construction yet, and that something is still wanting in reliability to enable such a voyage as the one we are discussing to be made in safety.

In this connection it must be remembered that this flight is more severe in its conditions than even the England-Australia adventure, even though the latter be the longer in point of distance. The climatic conditions which have to be encountered on the Cairo-Cape route are peculiar to the Dark Continent. They are not reproduced anywhere, with the possible exception of the valley of the Amazon. Variations between the ground temperature and that of the upper air are tremendous, and it seems to have been this question of extremes which has had most to do with the failure of engines which have proved their almost super-reliability in other flights. In actual commercial practice the single machine will not be required to make the whole journey, which will be accomplished in relays, so that the difficulties we are discussing now will hardly arise because of the fact that it will be possible to adapt engines and machines to areas, so to say, and there will be an adequate supply of spare parts and repair facilities to hand at every aerodrome and landing ground along the route.

Another factor which seems to have considerably hampered the pioneers of the Cairo-Cape route is the want of lifting power in the air during the heat of the day and at high altitudes. This is a phenomenon which became very well known to our flying men during the African campaigns of the War. Practically all the flying, especially in East Africa, had to be done before 10 o'clock in the morning, else the lifting power of the air was insufficient to give a good altitude. True, the machines in use were not too heavily powered—it was very much the practice to send out obsolescent types which would have been turned down as school machines in England—while "Silver Queen" and her consorts were able, full-powered machines. The peculiar conditions seem to call for rather less engine power and greater plane area in certain sections. It was not only this peculiar quality of the air which hampered the flights. Heavy rains, violent thunderstorms, whirlwinds and the smoke caused by bush fires all played their malign part in the failures. Col. van Ryneveld records that he was chased by a flying sandstorm at such headlong speed that he flew 366 miles in less than three hours! Evidently flying over the African bush and desert is no pursuit for the halt or those weak in nerve. But conditions will improve rapidly now that it has been proved possible—in spite of temporary failure—to make the complete journey in the air. It must be remembered when assessing the comparative value of the lessons learned from these flights that what has been attempted is by far the most difficult aerial enterprise which has so far been undertaken. Conditions of country and of climate could hardly be worse than they are. Almost unsurveyed and with temporary landing grounds carved out of the dense bush, with practically no supplies of spares and wanting in facilities for repairs, the conditions of the route are at the moment such that the airmen who essay to cross it, either succeed or they do not. That is the only way it can be expressed. It must be so in all these pioneer long-distance flights, and failure, in this case, though it is disappointing, so far from proving that the thing is impossible, really demonstrates how easily possible it is when organisation is better and surveys have been completed. Bad as the climatic conditions are, they are not impossible by a very long way. All the rest is merely a matter of human prevision and organisation. The lessons which have been learnt are of the utmost value and will assist materially in the future of the African Adventure.

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A Customs Handicap

A North of England firm—to wit, the Blackburn Aeroplane Co.—in order to discount the delays due to transport congestion, is on the point of inaugurating an aerial service from near Hull to the Continent via Amsterdam. There is nothing extraordinary in that, because the value of the speed and certainty of such services is becoming increasingly recognised by the business community, and we look to the institution of fresh aerial routes almost from day to day. But this enterprise draws attention to what is likely to develop into a serious handicap to enterprise unless it receives the favourable attention of the Air Ministry and the Customs authorities. At present, this route can only be operated by way of the Customs examination station at Lympne, near Folkestone, which is the sole recognised place of departure for the Continent. What it means is that machines flying from the North to Holland or the Baltic lose half their flying time by taking this route in comparison with what would be occupied if there were a departure station on the East Coast. As a matter of fact, the loss of time is even greater than the mere expression of "flying time" would convey, because of the fact that a landing at Lympne means the extra delay of a night. Added to this there is the question of extra cost of running the service, which may be taken to be roughly one-third of the whole.

We are aware that the Air Ministry, when its regulations for civilian aviation were formulated, agreed that in the time to come it would be necessary to establish other stations, and the question now arises whether that time has not come already. It may be readily agreed that such stations mean expense to the nation; but as an off-set it can equally be argued that such facilities may be regarded as a part of that policy of encouragement which the Government has many a time and oft promised to extend to aviation. Even if a new East Coast station were initially run at a loss, we submit that such loss would be more than compensated by the extra facilities it would afford to the development of new Continental services, and that it would be very temporary, since before very long we should see a great increase in the number of such services. On all counts there seems to be a strong case made out for more and better facilities for Customs examination of machines bound for the Continent from the northern counties.

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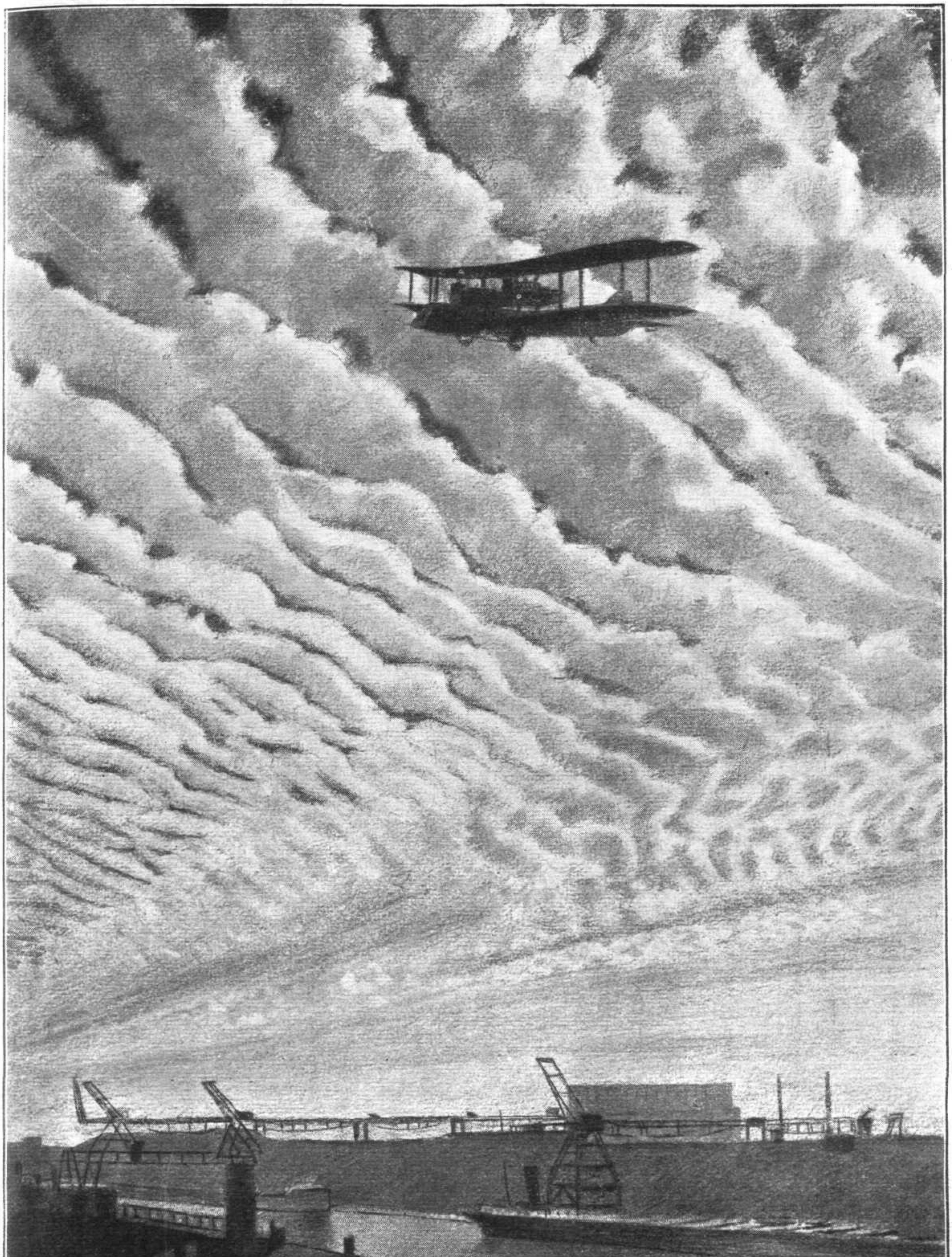
Aerial Services in the French Strike

The recent strike on the French railways gave the aeroplane an opportunity of showing its capacity as a means of transport. The British services were duplicated, and in one case at least more than doubled. Newspapers were quick to take advantage of its powers by sending their editions by air. *The Daily Mail*, in particular, in order to ensure that English visitors to the Riviera should not be without their usual news, sent aeroplanes from Paris to Lyons, whence the papers were conveyed by motor-car to the principal points for distribution.

Gradually but very surely the aeroplane is taking its place as an ordinary vehicle of transport. Every incident, such as this unfortunate railway strike, draws more and more attention to the outstanding fact that aerial transport is now a factor to be seriously reckoned with and that it is no longer hampered by the uncertainty which is inherent to all new and untried methods of conveyance. It is doubtless regarded, even now, as something of a feat for an enterprising daily, published in Paris, to be able to distribute its papers at the accustomed time in the absence of railway services. People who do not trouble to think too deeply may be inclined to look at the performance as purely an emergency effort, only to be adopted in default of something better being at hand. We would remind such, however, that twenty years ago they would have regarded delivery by motor car in the same light, but now they would—and quite rightly—deem it a commonplace. The sober fact of the matter is that the aeroplane of 1920 is really a more reliable vehicle of transport than was the car of 1900. There may be some who would be inclined to question this, but we submit that the contention is borne out by the facts. It is only a few weeks ago since we published and commented upon the Air Ministry's report on the working of such regular aerial services as are now in operation



A STUDY OF ALTO-CUMULUS CLOUD : A D.H. 10 aeroplane with Liberty engines is seen silhouetted against the cloud layer. (*From an original drawing by Roderic Hill*)

in this country, and these show that the percentage of failures *en route* is quite negligible. Twenty years ago the number of successful non-stop journeys made by motor car was but a fraction of the whole. Then the motorist who succeeded in making a non-stop run of fifty miles talked about it for a week, and as for getting to Brighton and back without trouble, it was scarcely to be thought about let alone accomplished. That is not the record of the aeroplane now. In certainty and reliability of engines and machines it has passed far out of the pioneer stage and has taken its place in line with other and older modes of transport.

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Trading with Germany

The British Association of Trade and Technical Journals recently entertained at luncheon the President of the Board of Trade, Sir Auckland Geddes. Among a great many other interesting things he said, one must be singled out for special treatment. A specific question was put him by the chairman, Mr. Percival Marshall: "Should the technical journals of this country accept advertisements from German firms?" We have quoted the question textually, but it might just as well have been put on a broader basis: "Shall Britain trade with Germany?" That is what it amounts to in the end. Replying, Sir Auckland said that Germany must be put on her feet again. We must restore her purchasing power to buy the things we manufacture. Many people would answer, "No" to the question, but he was not afraid to say "Yes." That would annoy a few people who could not see beyond their own noses, and those who never wished to have anything to do with Germany. The latter looked at the matter purely from a sentimental point of view, but he regarded it from a purely business point of view.

We are completely in agreement with the President of the Board of Trade, both in his views and in his manner of expressing them. We have no more love for the Hun than anyone, and were it within the bounds of practical business policy we would subscribe to the doctrine of no more dealing, socially or in business, with any of his breed. Unfortunately, however, the community of nations—like any other community—is made up of all sorts, and we have to take them as we find them. We all have to do business with individuals we do not like and as a nation we have simply got to face the fact, an unpleasant one to many, that we have got to do business with Germany. If we destroy her economically by refusing to trade we shall so upset the commercial balance of the world that we cannot continue in commercial health ourselves. We hope to secure payment of compensation, for some of our war losses, but unless we give our defeated enemy a chance to retrieve a part of his commercial status it is obvious he will never be in a position to pay. That is not by any means the worst aspect of a steady refusal to do business. If such a policy were to be rigorously followed out by the rest of the world, the inevitable result must be the early bankruptcy of Germany, and there is no need to stress the point that this would be absolutely disastrous to the whole commercial and industrial world. The plain fact of the matter is that we have got to put sentiment behind us and to trade with Germany again and the sooner we make up our minds as a nation that this is so the sooner we shall achieve the industrial reconstruction of the world.

The Air Estimates

The Air Estimates for the ensuing financial year were published as a White Paper on Monday last. They show in the total a reduction of more than half as compared with last year, the respective figures being £54,030,850 for last year, against £21,056,930 for this. The principal reductions are one of £13,000,000 for warlike stores and of over £16,000,000 in the pay of officers and men of the R.A.F. On the other hand, the estimated cost of the Air Ministry shows an increase of about £200,000. In the matter of the *personnel* of the R.A.F., this has been reduced in the present Estimates to about a fifth of the numbers provided for during the financial year 1919-20.

The appropriation for civil aviation amounts to £894,540, which is absorbed in various ways, of which the item "Works, lands and buildings" accounts for nearly half the amount. The sum of £2,575,540 is set aside for experimental and research services, but of this no less than £1,334,000 figures under the heading of "Liquidation of war liabilities." We miss altogether any specific mention of sums to be devoted to the direct encouragement of civilian aviation, though it is fair to acknowledge that £28,500 is to be spent on flashing lighthouses and a further sum of £172,000 on buildings on Imperial air routes. We should, however, have preferred to have seen some visible evidence of the intentions of the Government to really extend the helping hand to the development of the active side of civilian aviation. As it is, there is none and the firms who have been watching and waiting for promises to materialise into actions are still left with nothing but the hope that possibly the Civil Service Estimates may disclose that the Government, through the Post Office, will really redeem those promises by the subsidy in some shape or form of aerial mail services. At the best this is but a slender hope.

Then, in the matter of the drastic reductions in the *personnel* of the R.A.F. we cannot view the policy of the Government with anything less than grave misgiving. Economy is undoubtedly necessary now, but not such economy as will leave us open to attack by any aggressive Power at its own chosen moment. Last year we were told that the strength of the R.A.F. was to be reduced by the 31st of this month to 35,000 officers and men, which seems to be small enough in all conscience. The present Estimates disclose, however, that a further drastic cut has been made and that the numbers are now to be reduced to an establishment of 29,730, including the staffs employed at the Air Ministry, for the services of civil aviation and for experimental and research work. This, too, at a time when it looks as though we might easily have to undertake further serious military operations in the Near East. With the lessons of Somaliland and the Indian frontier fresh in mind, this looks on the face of it a policy of penny wise and pound foolish. However, criticism in detail would be premature until the Estimates have been formally introduced and debated, but this we may say here and now: that if the Estimates disclose one thing with greater clearness than another it is that it is wholly wrong policy that one Minister, however able, should be at the head of two fighting Services. The Army Estimates for which Mr. Churchill was so recently responsible, showed a strong tendency upwards. The Air Estimates, which are even more

linked up with the safety of the Empire and for which he is equally responsible, tend in the direction of dangerous economy. The clear inference is that the Minister has allowed himself to be swayed by the brass hats of the War Office, while the officials of the Air Ministry, with less opportunity for access to the Ministerial ear, have not been as fortunate.

Cantilever Wings

One of the most remarkable phases of German aeroplane design during the last year or so of the War was the ever-increasing employment of thick tapered wing sections without external bracing. At first this form of wing was employed on the relatively small Fokker triplanes only; but later it was adopted in a somewhat different form for much larger machines, such as, to mention only a few, the Fokker D VII biplane, the armoured Junkers biplanes and monoplanes, and the Hansa Brandenburg monoplane seaplanes. In spite of the growing popularity of this type of wing in Germany our own authorities paid little or no attention to it, probably because the wing was not considered sufficiently efficient for war purposes where the last ounce of efficiency often meant the difference between success and failure.

For civilian use, however, other considerations may well outweigh extremely high efficiency, and viewed from this standpoint the subject of the cantilever wing assumes a rather different aspect. Elsewhere in this issue we publish the first instalment of an article by "Marco Polo," in which he attempts to arrive at figures for a tapered cantilever wing, basing his estimate on figures taken from R. & M. No. 322, relating to sections suitable for airscrew design. Although these sections may not be the best possible for a cantilever wing they should give a fair indication of the results that may be expected from a wing of this type, since an airscrew is virtually a cantilever wing, although its sections travel along a spiral path instead of a straight line.

Later in his article, "Marco Polo" indicates some uses of the cantilever wing which would appear to render it especially suitable for small and medium-sized machines, and we would welcome the views of designers on the opinions and suggestions put forward in the article, since the subject is one which may well have considerable influence upon future wing design for small sporting machines. To our way of thinking the greatest advantage of cantilever wings is that they will probably not require the same amount of trueing up as do the ordinary braced wings. This is an advantage which will count heavily with the owner-pilot of the future, who will certainly not wish to be bothered by constantly having to go over his wings with spirit level and plumb line to check the truth of his planes and to tighten up or adjust flying and incidence wires.

Mr. Handley-Page recently visualised the small, low-powered machine which one keeps in the coal shed and wheels out of an evening or week-end to go for a flip. It may well come about that this machine will have cantilever wings which pivot in the manner suggested by "Marco Polo," since this certainly appears to be one of the simplest methods of "folding" which have so far been invented. Not only this, but, as we have already said, the comparative absence of trueing-up worries should be a strong point in favour of this type of wing.

As to the actual detail construction of such a wing, there is ample choice. Some will doubtless adhere to the wood construction which has stood the test of time and experience in the ordinary wing, while others will see in the cantilever wing a new field for metal construction. It is on matters such as these that we would welcome the opinions of practical designers and constructors, and we shall be pleased to open our columns to a discussion of the merits and drawbacks of the various points in the design, construction and practical utilisation of the cantilever wing.

THE AIR SERVICE ESTIMATES

THE Estimates for the Air Ministry and the Royal Air Force for the year 1920–21 were issued as a White Paper on Monday. It is impossible to reproduce the Estimates in full, but in the following tables will be found details of the various Votes which will show how the total of £21,056,930 is to be distributed.

ABSTRACT OF AIR ESTIMATES, 1920–21.

Pages.	Votes.	——	Net Estimates, 1919–20.	Net Estimates. 1919–20.	Votes.
		I.—*Numbers:*			
3	A.	Total number of officers, warrant officers, non-commissioned officers, airmen and boys on the Establishment of the R.A.F., exclusive of those serving in India	29,730	150,000	A.
		II.—*Effective Services:*	£	£	
4	1	Pay, etc. of the Air Force ..	4,661,000	21,051,000	1
9	2	Quartering, stores (except technical), supplies and transport	2,005,000	6,103,000	2
12	3	Technical and warlike stores ..	6,172,850	19,322,850	3
15	4	Works, buildings and lands ..	3,647,000	6,402,000	4
21	5	Air Ministry	877,000	692,000	5
32	6	Miscellaneous effective services	110,000	203,000	6
37	8	Civil aviation	894,540*	‡	8
44	9	Experimental and research services	2,575,540*	§	9
		Total effective services ..	20,942,930	53,773,850	
		III.—*Non-Effective Services:*			
34	7	Half pay, pensions and other non-effective services ..	114,000†	257,000	7
		Total effective and non-effective services	21,056,930	54,030,850	

* Includes certain non-effective charges in respect of these services.
† Excludes certain non-effective charges in respect of Civil Aviation and Experimental and Research Services. These are included under Votes 8 and 9 respectively.
‡ Provided under Votes 1 to 7 in 1919–20.
§ Provided under Votes 1 to 7, under the Votes of the Ministry of Munitions, and for part of the year 1919–20 under Navy Votes.

VOTE A.—*Number of Officers, Warrant Officers, Non-Commissioned Officers. Airmen and Boys on the Establishment of the R.A.F., exclusive of those serving in India.*

Under which Vote provided.	Rank, etc.		Total. 1920–21.	1919–20
Vote 1	Air officers	12		
	Commissioned officers	2,880		
	Cadets	152		
	Warrant officers	324		
	Non-commissioned offiers	2,900		
	Airmen	19,760		
	Boys	3,480		
	Total, Vote 1		29,508	
Vote 5	Air officers	7		150,000
	Commissioned officers	144		
	Other ranks	43		
	Total, Vote 5		194	
Vote 8	Commissioned officers	6		
	Other ranks	12		
	Total, Vote 8		18	
Vote 9	Commissioned officers	10		
	Total, Vote 9		10	
	Number to be voted		29,730	150,000

VOTE 1.—*Pay, etc., of the Air Force.*

	Estimates. 1920–21.	1919–20.
	£	£
A.—Pay and personal allowances of officers.. ..	1,409,000	4,600,000
B.—Pay and personal allowances of men	1,558,000	6,400,000
C.—Separation allowance	566,000	2,250,000
D.—Miscellaneous allowances	7,000	500,000
E.—Women's Royal Air Force	5,000	900,000
F.—Civilians	750,000	1,601,000

G.—Service gratuities to officers and men on discharge, etc.	250,000	5,100,000
H.—Air Force reserve	77,400	30,000
J.—Recruiting staff and expenses	108,600	120,000
Gross total	4,731,000	21,501,000
Deduct—		
K.—Appropriations in aid	70,000	450,000
Net total	4,661,000	21,051,000

VOTE 2.—*Quartering, Stores (except Technical), Supplies and Transport.*

	Estimates. 1920–21.	1919–20.
A.—Hire of buildings, lodging and special accommodation allowances	210,000	200,000
B.—Barrack services	30,000	46,000
C.—Fuel and light	150,000	400,000
D.—General stores	159,000	720,000
E.—Clothing	250,000	2,195,000
F.—Provisions, horses and forage	851,000	1,756,000
G.—Medical services	85,000	195,000
H.—Transport	470,000	1,200,000
Gross total	2,205,000	6,712,000
Deduct—		
J.—Appropriations in aid	200,000	609,000
Net total	2,005,000	6,103,000

VOTE 3.—*Technical and Warlike Stores.*

	Estimates. 1920–21. £	1919–20. £
A.—Aeroplanes, seaplanes, engines and spares ..	1,389,750	1,413,000
B.—Airships, airship engines and spares	37,000	144,000
C.—Balloons, winches and spares	50,400	72,300
D.—Aircraft technical and warlike stores	132,200	158,550
E.—Armament and ammunition	216,300	168,200
F.—Electrical stores	81,750	54,900
G.—Miscellaneous engineering stores..	111,150	114,800
H.—Miscellaneous materials	126,500	*
J.—Hangars	11,700	64,500
K.—Mechanical and other transport	233,600	23,000
Marine craft and equipment	†	*7,500*
L.—Petrol and oil	482,500	1,522,100
M.—Rewards to inventors	500,000	‡25,000
N.—Aircraft supplies delivered under war contracts (including compensatory payments)	3,500,000	16,100,000
Gross total	6,872,850	§19,867,850
Deduct—		
O.—Appropriations in aid	700,000	545,000
Net total	6,172,850	§19,322,850

* Provided under Vote 2, sub-head D, and under other sub-heads of Vote 3 in 1919–20.

† Now included under sub-head K.

‡ Provision for rewards to contractors was made under the Votes of the Ministry of Munitions in 1919–20.

§ Includes provision for Civil Aviation and Experimental and Research Services, now made under Votes 8 and 9.

VOTE 4.—*Works, Buildings and Lands.*

	Estimates. 1920–21. £	1919–20. £
A.—Staff for works services	194,500	155,000
Part I.		
B.—New works, additions, alterations, and special repairs amounting to £2,000 each and upwards	2,058,000	5,072,000
Part II.		
C.—Minor new works, additions, and alterations under £2,000 each	105,000	135,000
Part III.		
D.—Ordinary repairs and maintenance	785,000	921,000
E.—Grants in aid of works	5,000	5,000
F.—Purchases of lands and buildings	358,000	217,000
G.—Rents, compensations and reinstatements ..	385,000	248,000
H.—Incidental expenses of air Ministry estates ..	13,000	2,000
J.—Provision of telephone and telegraph services..	9,000	10,000
K.—Miscellaneous works services	19,000	30,000
L.—Purchases of stores and plant for works (net)..	30,000	6,000
M.—Machine tools	35,000	†
Gross total	3,996,500	6,801,000
Deduct for probable underspending on the Vote as a whole	200,000	
	3,796,500	
Deduct—		
N.—Appropriations in aid	149,500	399,000
Net total	*3,647,000	6,402,000

* Further provision for Works Services is included under Votes 8 and 9.

† Provided under Vote 3 in 1919–20.

VOTE 5.—*Expense of the Air Ministry.*

	Estimates. 1920–21. £	1919–20. £
A.—Salaries and allowances of the Air Council, secretariat, and Finance Department.. ..	275,327	* §257,422
B.—Salaries and allowances of the Department of the Chief of the Air Staff	278,535	317,378
C.—Salaries and allowances of the Department of the Controller-General of Civil Aviation ..	109,742	†38,523
D.—Salaries and allowances of the Department of the Director-General of Supply and Research	175,000	‡
E.—Pay of messengers and porters	34,329	76,777
F.—Contingent expenses	5,067	2,000
Gross total	878,000	692,100
Deduct—		
G.—Appropriations in aid	1,000	100
Net total	877,000	692,000

* Includes war bonus in respect of departments of the Chief of the Air Staff and the Controller-General of Civil Aviation.

† Excludes salaries and allowances of the Meteorological Office, provision for which was made in 1919–20 under Vote 6, sub-head G (G), Air Estimates, and Class IV, Vote 8, sub-head B, Civil Service Estimates.

‡ In 1919–20 provision was made under the Votes of the Ministry of Munitions.

§ Includes overtime in respect of Department of the Chief of the Air Staff.

VOTE 6.—*Miscellaneous Effective Services.*

	Estimates. 1920–21. £	1919–20. £
Field intelligence	—	*1,000*
A.—Compensation for losses, etc.	25,000	26,000
B.—Losses by exchange, etc.	5,000	20,000
C.—Medals	10,000	52,000
D.—*Postal*, telegraphic and telephone charges ..	20,000	20,000
E.—Advertisements	3,000	3,000
F.—Miscellaneous	48,000	53,000
Grant for Meteorological Office	*	*12,000*
Extra regulation expenditure	—	*1,000*
Prisoners of war	—	*1,000*
Demobilisation education scheme	—	*15,000*
Gross total	111,000	204,000
Deduct—		
G.—Appropriations in aid	1,000	1,000
Net total	110,000	203,000

* Now provided under Vote 5, sub-head C, and Vote 8, sub-head G.

VOTE 7.—*Half Pay, Pensions, and other Non-Effective Services*

	Estimates. 1920–21. £	1919–20. £
A.—Rewards to officers, warrant officers, non-commissioned officers and airmen	1,500	300
B.—Half pay of officers	8,000	1,400
C.—Retired pay and gratuities of officers	22,000	10,800
D.—Pensions and gratuities to wounded officers ..	47,000	233,000
E.—Service pensions (airmen)	8,500	3,000
F.—Pensions and compassionate allowances to widows and children	18,100	500
G.—Civil non-effective payments: recurrent charges	800	1,000
H.—Civil non-effective payments: gratuities and other non-recurrent charges	900	1,000
J.—Injury grants	7,300	7,000
K.—Commutation of compensation allowances ..	—	—
Gross total	*114,100	258,000
Deduct—		
L.—Appropriations in aid	100	1,000
Net total	*114,000	257,000

* Excludes certain non-effective charges in respect of Civil Aviation and Experimental and Research Services. These are included under Votes 8 and 9 respectively.

VOTE 8—*Civil Aviation*

	Estimates. 1920–21. £	1919–20. £
A.—Salaries and wages	†85,000	
B.—Stores (except technical) and transport ..	126,000	
C.—Technical equipment	236,000	*
D.—Works, buildings and lands	415,000	
E.—Miscellaneous	3,000	
F.—Non-effective services	1,000	
G.—Meteorological services	‡77,629	—
Gross total	943,629	—
Deduct—		
J.—Appropriations in aid	49,089	—
Net total	† ‡894,540	—

* A new Vote. In 1919–20 the cost of Civil Aviation was provided under Votes 1–7.

† Excludes the cost of the Headquarters Staff of the Controller-General of Civil Aviation, provision for which is made under Vote 5, sub-head C.

‡ Excludes the cost of the Headquarters Staff of the Meteorological Office, provision for which is made under Vote 5, sub-head G. In 1919–20 the cost of this service was provided under Civil Service Estimates, Class 4, Vote 8, sub-head B and Vote 6, sub-head G (G) Air Estimates.

VOTE 9.—*Experimental and Research Services*

	Estimates. 1920–21. £	1919–20. £
A.—Salaries and wages	†48,800	
B.—Aeronautical inspection department	80,300	
C.—Stores (except technical) and transport.. ..	6,700	
D.—Technical equipment and materials	844,390	
E.—Royal Aircraft Establishment, Farnborough ..	401,200	*
F.—Works, buildings and lands	140,000	
G.—Miscellaneous	5,000	
H.—Non-effective charges	2,150	
J.—Airship constructional establishment	315,000	
K.—Liquidation of war liabilities	1,334,000	
Gross total	3,177,540	
Deduct—		
L.—Appropriations in aid	602,000	
Net total	†2,575,540	

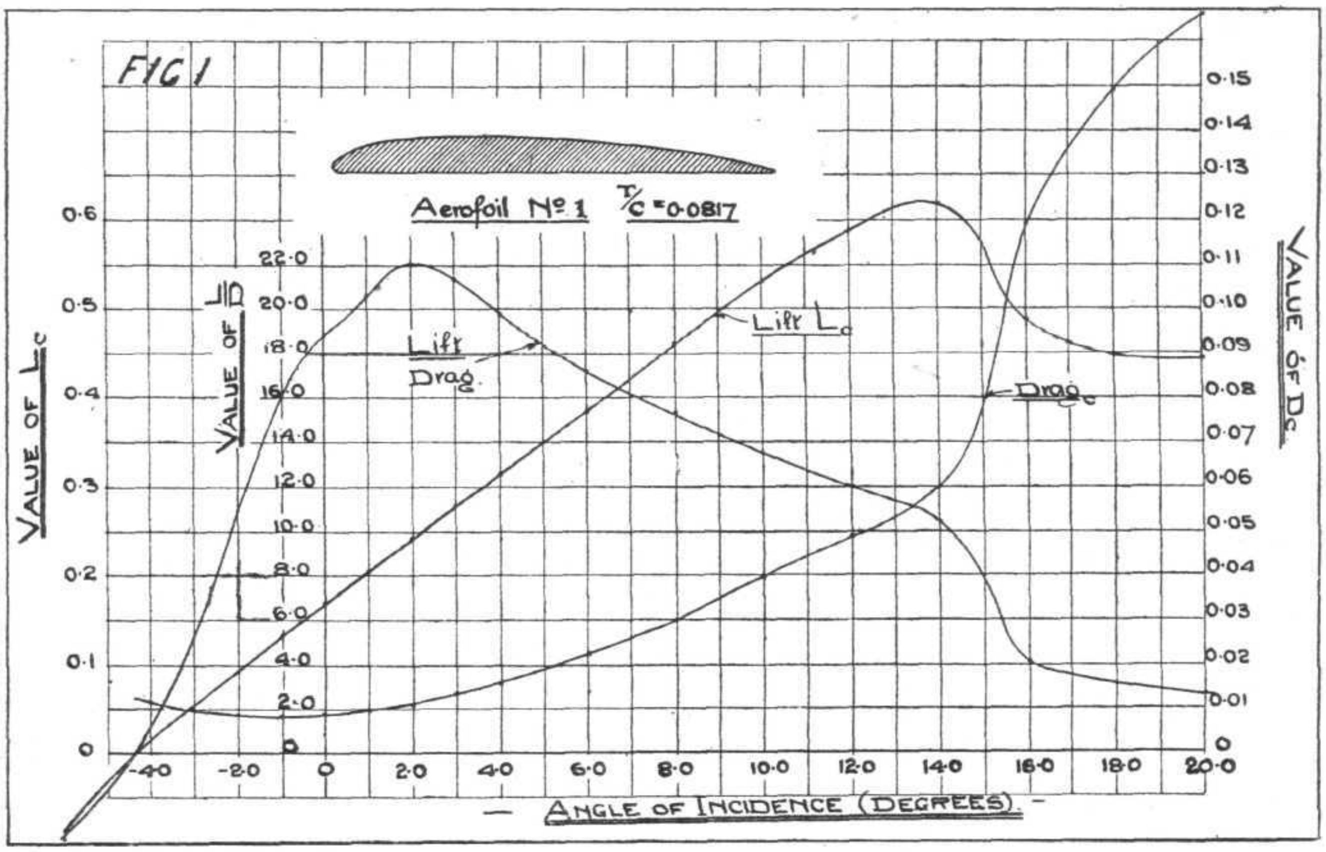
* A new Vote. In 1919–20 the cost of Experimental and Research Services was provided under Votes 1 to 7 of the Air Estimates, under the Votes for the Ministry of Munitions and for part of the year from Navy Votes.

† Provision for the cost of the Headquarters Staff of the Director-General of Supply and Research is made under Vote 5 D.

THE CASE FOR THE CANTILEVER WING

BY "MARCO POLO"

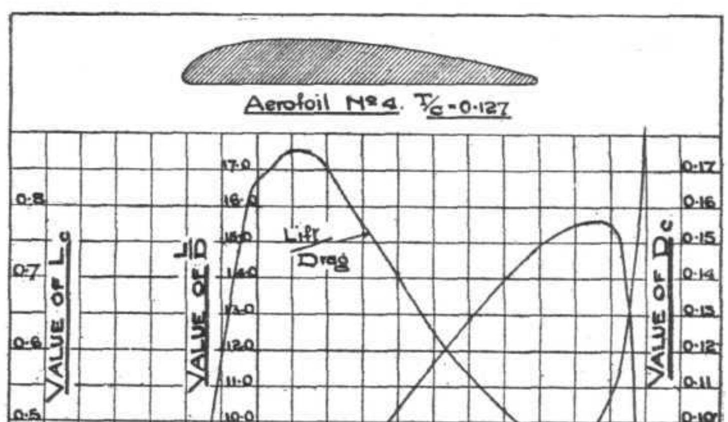
PROBABLY the first example of aeroplanes with wings having no external wing bracing, or, as they are now generally called, cantilever wings, to fall into our hands was the Fokker triplane, a specimen of which was on view at the Enemy Aircraft Exhibition at the Agricultural Hall, Islington. Although this machine was by no means beyond criticism as regards its wing construction, it nevertheless marked a very important step in wing design, one that was to play an important part in the future development of German wing design as applied to small and medium-sized machines. One need only refer to such well-known types as the Fokker D VII, the armoured Junkers, and the Hansa Brandenburg seaplanes, which latter at one time were a serious menace to our aerial supremacy in the North Sea.



In spite of the successes scored by the different types of cantilever wing machines, our own authorities remained singularly indifferent to the thick wing section. So much so, that, up to the time of writing, no deep wing resembling the Fokker or Junkers has been subjected to wind tunnel tests at the National Physical Laboratory. It is true that a thick section *has* been tested in model form, but this represented the centre section of a Fokker wing, and thus is by no means a criterion of the characteristics of the complete wing. From tests it was known, long before the advent of the German cantilever wings, that a deeply cambered section, although it may have a high maximum lift coefficient, is not as efficient as some thinner wings, *i.e.*, has a relatively low value of L/D. This fact it was, apparently, which kept our designers and aeronautical experimenters from paying any attention to the thick, tapered wing section.

The writer has discussed this wing section with several of our designers, and in the majority of cases their argument was somewhat as follows: "Yes, that is all very well, but the thick section is inefficient. There is nothing in it." I entirely agree, so long as one means by a thick section a uniform thick section. But when we come to the *tapered* section, washed out in camber, incidence, and chord from root to tip, then it is possible that quite a different light is thrown on the subject.

It is in order to attempt an estimate of the characteristics of a thick *tapered* aerofoil that the writer has summed up his courage and has dared to oppose the consensus of opinion of those whose experience is vastly superior, and has tried to form an approximate estimate of what a complete wing of thick section at the root, tapering in plan form and having a decreasing camber towards the tip, may reasonably be expected to give in the way of maximum lift coefficient, L/D, etc.



What chiefly prompted the writer to take an interest in the thick cantilever wing was not any surmise based on deep aerodynamical knowledge—Heaven forfend such a presumption—but the evidence of growing popularity of this type of wing in Germany. Common sense appeared to indicate that the German authorities, "up against it" as they were, would scarcely allow this type of wing to be so extensively employed, merely to oblige private firms like Fokker or

Junkers, etc., if the wing was very inferior aerodynamically to other and more orthodox sections. What further appeared to the writer to indicate that these wings were not chosen without a good and sufficient reason was the fact that the Göttingen Institute (which corresponds to our National Physical Laboratory) has tested a *bagatelle* of between 300 and 400 different wing sections, and that it is, therefore, scarcely likely that, with such data to choose from, a very inferior wing would have been allowed to get as far as the fighting front in any numbers.

The writer had hoped that either the National Physical Laboratory or one of our private establishments possessing a wind tunnel would have considered the subject worthy of a test, but up to the present this does not appear to have been the case. In the absence of results of model tests I have, therefore, attempted to make an estimate of the data of such a wing, and although there are admittedly too many unknown or uncertain factors in the estimate to make it as absolutely conclusive as would be a model test, it is hoped that the results arrived at may cause sufficient interest to lead to thorough wind tunnel tests being made on such wings, either by the National Physical Laboratory or by private firms.

As a basis on which to build up an estimate of the characteristics of a thick tapering wing, use has been made of the results of tests at high speeds on six aerofoils suitable for airscrew design (Reports and Memoranda No. 322). The reason for choosing these sections is partly that some of them are thick sections which lend themselves to cantilever wing construction, and partly that they were tested at high speeds, and the data relating to them may, consequently, be used without scale correction. It is not necessarily suggested that these sections are the best possible for a cantilever wing, but they will serve as a very useful indication of what one may hope to obtain from a thick *tapering* wing.

Of the six aerofoils included in Reports and Memoranda No. 322, I have made use of sections No. 1 and No. 4, shown with their performance curves in Figs. 1 and 2, their dimensions being given in Tables I and II. Sections No. 5 and No. 6. are thicker than No. 4, but although section 5 has a slightly higher maximum lift coefficient, neither 5 nor 6 have so good an L/D ratio as No. 4. Also for the small machine I have in mind as being most suitable for cantilever wings, the extreme thickness of 5 or 6 is not required for the necessary strength, section No. 4 having a maximum ordinate of 0·127 of the chord. In order slightly to increase the wing depth

TABLE I.—*Aerofoil No. 1. Flat Under-Surface*

$$\frac{\text{Maximum thickness}}{\text{Length of chord}} = 0 \cdot 0817.$$

Radius at the nose = 0·0133 of chord.

Distance of maximum ordinate from nose = 0·3 of chord.

No. of ordinate.	Distance of ordinate from leading edge, expressed as a fraction of chord.	Length of ordinate, expressed as a fraction of chord.
1	0·05	0·0510
2	0·10	0·0651
3	0·20	0·0775
4	0·30	0·0817
5	0·40	0·0806
6	0·50	0·0761
7	0·60	0·0694
8	0·70	0·0593
9	0·80	0·0451
10	0·90	0·0273

TABLE II.—*Aerofoil No. 4. Flat Under-Surface*

$$\frac{\text{Maximum thickness}}{\text{Length of chord}} = 0 \cdot 1270.$$

Radius of the nose = 0·02 of chord.

Distance of maximum ordinate from nose = 0·3 of chord.

No. of ordinate.	Distance of ordinate from leading edge, expressed as a fraction of chord.	Length of ordinate, expressed as a fraction of chord.
1	0·05	0·0794
2	0·10	0·1020
3	0·20	0·1218
4	0·30	0·1270
5	0·40	0·1244
6	0·50	0·1151
7	0·60	0·1020
8	0·70	0·0860
9	0·80	0·0668
10	0·90	0·0423

in the centre rib, I have placed section No. 4 a short distance out, *i.e.*, as rib *c* in Fig. 3. Section No. 1 I have placed at *l*, Fig. 3.

For structural reasons it is an advantage to have tapered chord, and as a basis I have, therefore, chosen the taper shown in Fig. 3. This is, of course, quite arbitrary, and could be varied to any extent desired. To arrive at an estimate of the data of each of the ribs or sections, I have assumed that the rate of change in characteristics is proportionate to the distance of any section from the two sections of which the data are given. In other words, the data for each rib are arrived at by interpolation. In the case of ribs *a* and *b* the values thus obtained may not be strictly accurate, since these lie outside the given section, *c*, but it is thought that the inaccuracy will not be of any great importance to the general result. On the assumption, therefore, that this method is permissible, we arrive at the values of L_c and L/D shown in Figs. 4 and 5. The reason for plotting the results on two charts is that the curves would otherwise lie so close together that, in reproduction, they would "close up."

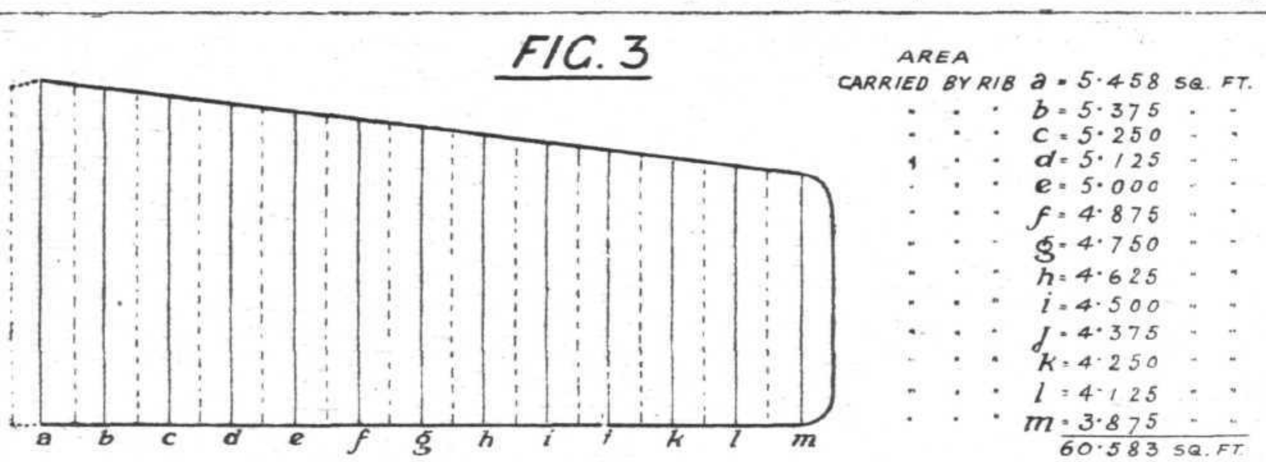


FIG. 3

Having now assumed data for each of the ribs or sections shown in Fig. 3, account must be taken, before figures of the complete wing can be arrived at, of the relative size of each section, since this will influence the final result. Also, for purposes of stability it is an advantage to have a "wash-out" of the angle of incidence. From considerations of the data of the inner and outer sections I have chosen a wash-out of 4°. That is to say, when the centre rib is at an angle of incidence of 4° the end rib has an angle of 0°. This amount of "wash-out" gives a wing like that shown in Fig. 6, in which alternate ribs only are plotted. The "wash-out" is obtained by rotating the ribs around the centre line of the plane containing the maximum ordinate. The dihedral is also determined quite arbitrarily, on this basis, the plane containing the maximum ordinates having a symmetrical taper in front elevation. By preparing a series of tables which take into account the wash-out and the difference in chord of the various sections, figures of the complete wing are obtained.

[It should be pointed out that while these figures take into account the shape and relative size of each section, they do not allow for *location*. That is to say, no account is taken of their distance out from the centre line. In the ordinary uniform wing it is known that the centre section is subject to greater lift than are the end ribs, but as no figures are available on which to base an estimate of the manner in which the pressure changes in a tapered wing, no attempt has been

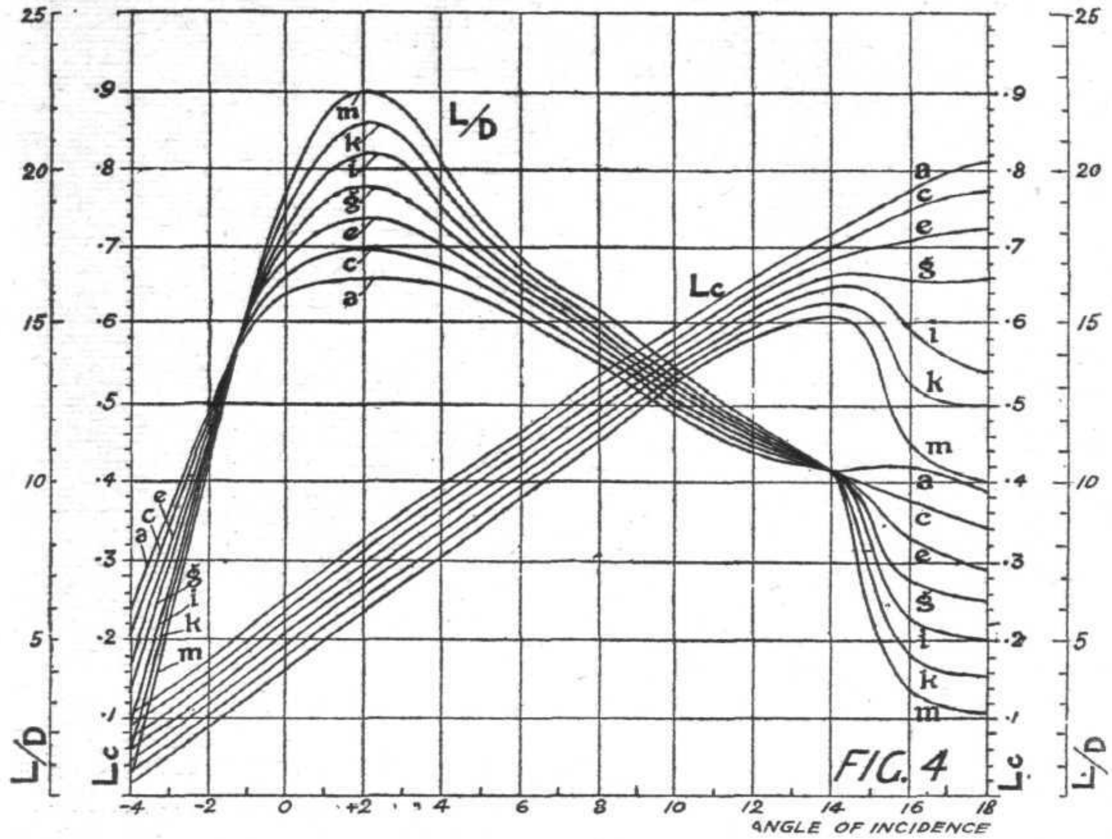


FIG. 4

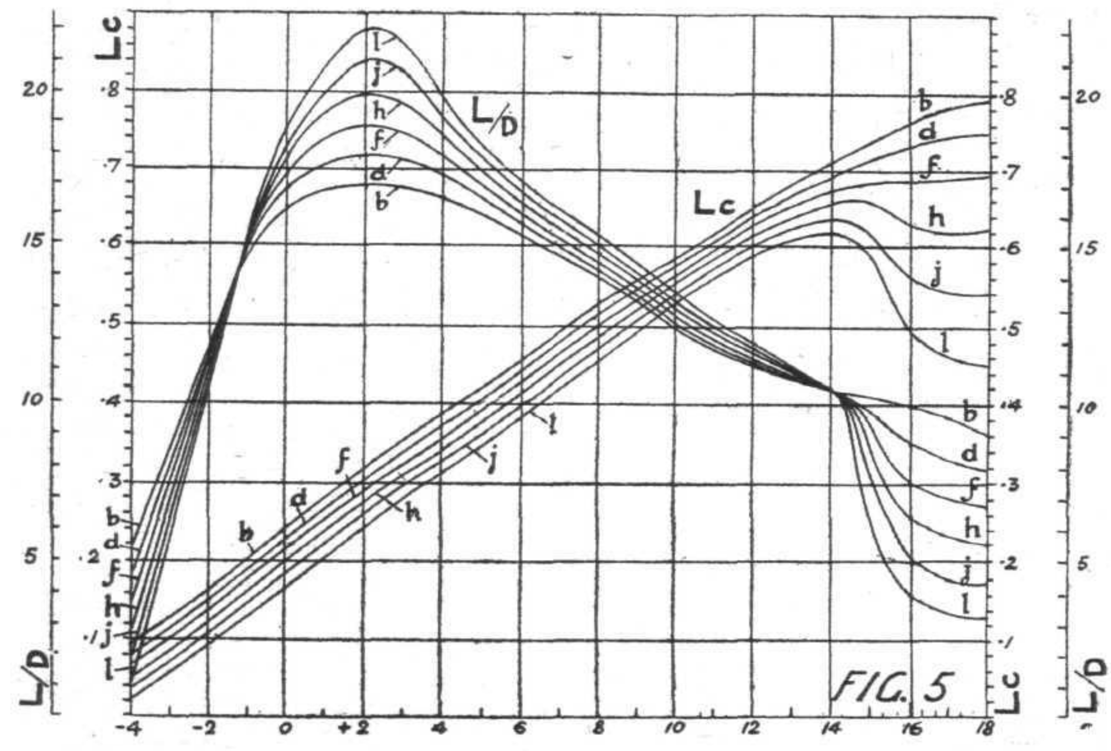


FIG. 5

made to allow for this. Presumably the effect would be to increase the lift on the inner ribs and to decrease that of the end ribs.]

These are plotted in Fig. 7. It will be seen that the maximum lift coefficient is ·71 at 18°, while the maximum L/D (full size value) is 18·3. If the methods employed for arriving at these results are justified, and the writer does not imagine that they will be very far out, the thick tapering wing is by no means so inefficient as many appear to think, considering that the maximum lift coefficient is high.

In order to compare the wing with other and more orthodox aerofoils, it is not sufficient to compare the lift and L/D curves on a basis of angle of incidence, nor even the L/D values plotted as ordinates against $\sqrt{\frac{Ky\ max.}{Ky}}$, since the ordinary aerofoil would require external wing bracing. It is, therefore, proposed to work out, for some given size of wing and some definite loading, the resistance of the cantilever wing and of RAF 15 for various speeds, corresponding to the loading.

As a basis for the comparison I have chosen the plan form shown in Fig. 3, assuming a chord of 5 ft. 6 ins. in the centre and 4 ft. at the tips, with a span of 25 ft. This gives an area of about 120 sq. ft. I have assumed that it is intended to build a small, light monoplane with low-power engine, say, of about 25 h.p. Such a machine could, it has been assumed, be built for a total weight, "all up," of 600 lbs. In the case of the cantilever wing this would thus give a loading of 5 lbs. per sq. ft., and, as the maximum lift coefficient is ·71, the landing speed would be about 37 m.p.h. In Fig. 8 is shown the wing resistance curve at various speeds for this area and loading. It will be seen that the lowest wing resistance is 32·5 lbs., at a speed of 59 m.p.h. On the same graph is plotted the curve of RAF 15, due regard having been paid to the fact that, for the same landing speed, the latter wing would have to be of larger area, as its maximum lift coefficient is only ·513, as against ·71 for the cantilever wing. In order to make a fair comparison, I have converted the L/D values of RAF 15 given in Report and Memoranda No. 248 to full-size values in accordance with the method given in R. and M. No. 450, Fig. 20. Consequently, the L/D values for RAF 15 are full-size ones (as far as it is possible to correct for scale effect), and the area of this wing is in proportion to the lower value of the maximum lift coefficient, *i.e.*, 166 sq. ft., against the 120 sq. ft. of the cantilever wing. A monoplane of area

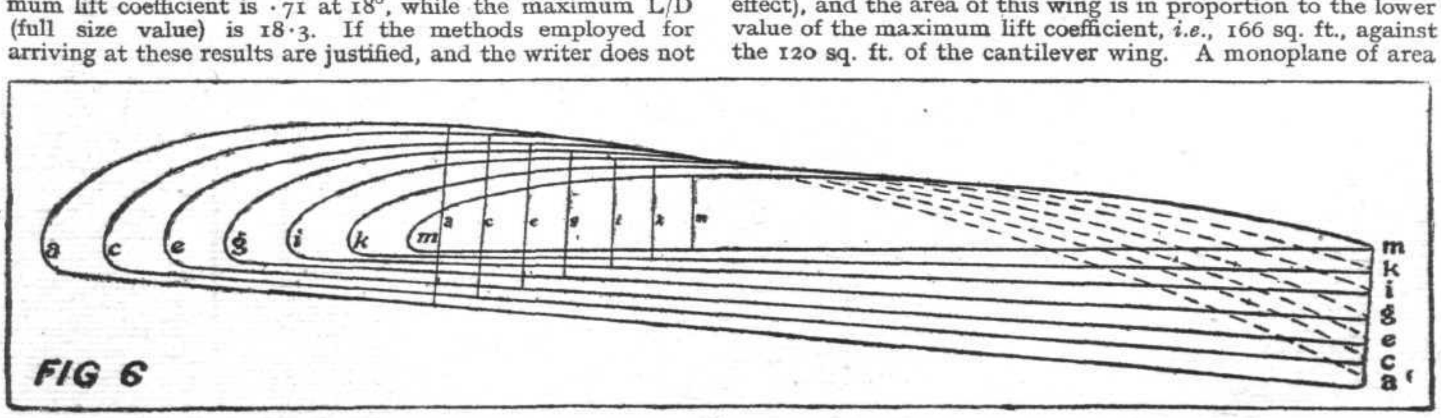
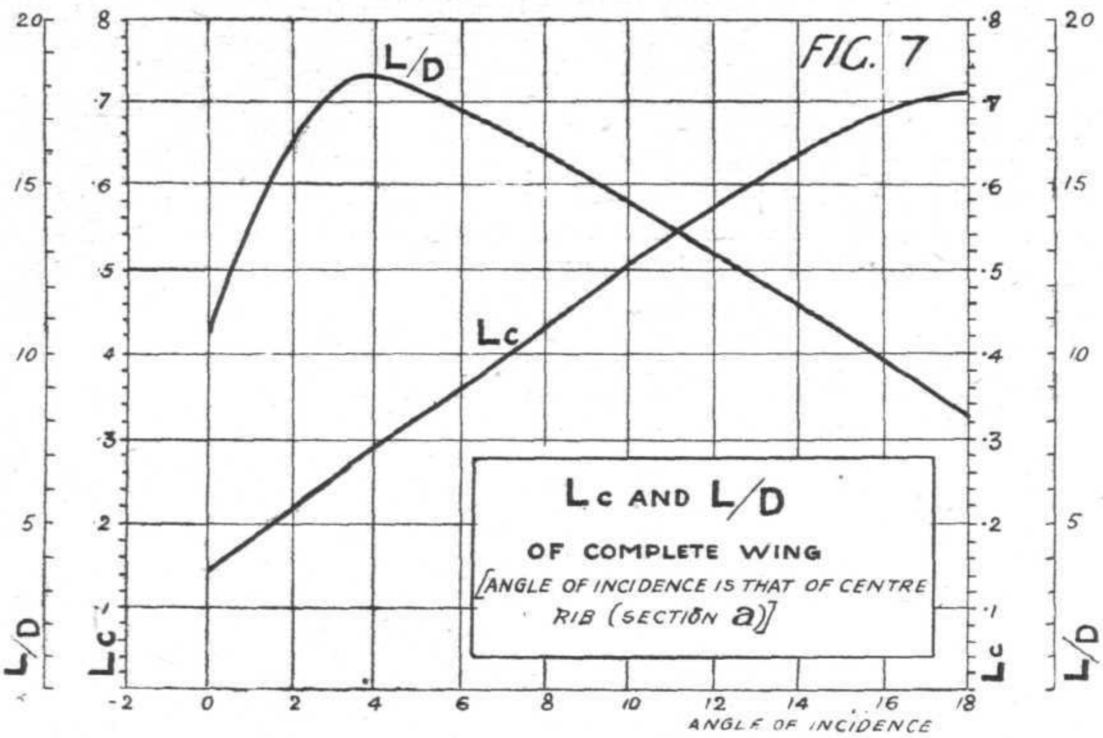


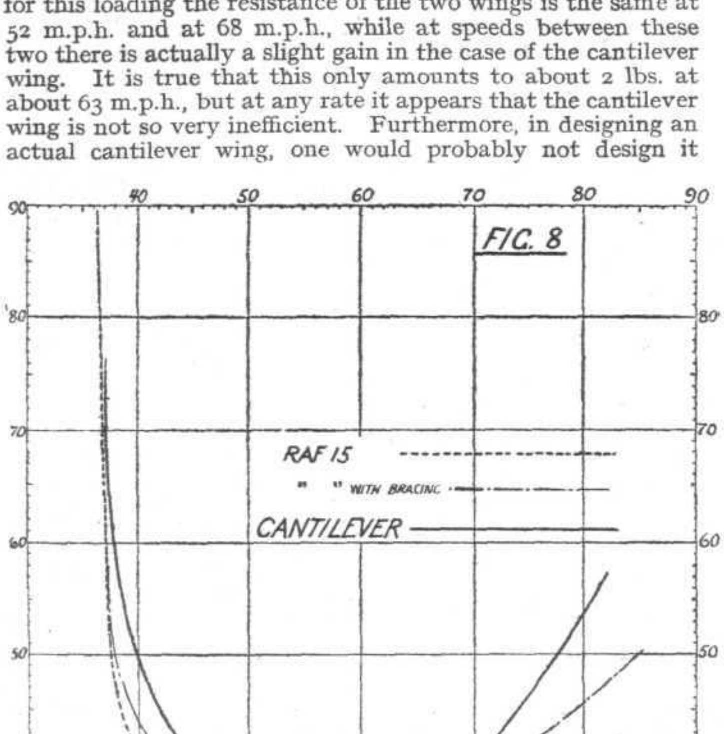
FIG 6



166 sq. ft. would require roughly 120 ft. of bracing wire, the resistance of which has been taken as 0·047 lbs. per foot at 60 m.p.h. The resistance of this wiring has also been plotted in the graph, Fig. 8, and, finally, this resistance has been added to that of RAF 15, giving figures of resistance for the complete RAF 15 wing with bracing. The curves show that for this loading the resistance of the two wings is the same at 52 m.p.h. and at 68 m.p.h., while at speeds between these two there is actually a slight gain in the case of the cantilever wing. It is true that this only amounts to about 2 lbs. at about 63 m.p.h., but at any rate it appears that the cantilever wing is not so very inefficient. Furthermore, in designing an actual cantilever wing, one would probably not design it with a perfectly flat bottom camber, and, consequently, a small gain might be expected.

From an aerodynamical point of view it would appear that the cantilever wing is not so bad as it has been painted, and it appears to the writer that it would be well worth while to have a model of one similar to the one outlined, or, better still, a model of the Fokker wing, tested in a wind tunnel to determine experimentally the data which here have been estimated from figures relating to propeller sections. That results even better than those just arrived at can be obtained is very probable, and the advantage of cantilever wings, as will be indicated shortly, for sporting machines of small and medium size, are quite considerable.

(*To be continued.*)



Flying from Holland to Java

FOR some time the Dutch Government has had under consideration the question of the practicability of an aeroplane flight from Holland to the Dutch East Indies, and it has been decided to offer a large money prize to the Dutch aviator who first completes the journey within 30 days.

Three competitors have entered, and it is expected that a start will be made in about three weeks from Soesterberg. Two of the competitors, Lieut. Backer and Lieut. Wulfte Palther, propose to fly together in a Vickers F. 3 flying boat, fitted with two Rolls-Royce " Eagles " of 350 h.p. each.

The third entrant who has entered for the competition is Lieut. Kotten, who proposes to use an Albatros machine, but there is likely to be some difficulty in arranging for assistance from British aerodromes along the route to an aeroplane of German origin.

The distance from Holland to Java is roughly 9,200 miles. Three routes have been mapped out, all of which coincide in part with that followed by Sir Ross Smith in his flight to Australia.

The one which Lieuts. Backer and Palther propose to follow is *via* Brest, Marseilles, Naples, Taranto, Piræus, Adalia, Famagusta, Abu Kemal, Basra, Bushire, Bander Abbas, Charbar, Karachi, Bombay, Mangalore, Tuticorin, Madras, Calcutta, Akyab, Rangoon, Mergui, Penang, Singapore, Muntok and Batavia.

Aviation for South America

DURING a visit to New York Senor Francisco Yanes, formerly in the Venezuelan Consular service, and now Assistant Director of the Pan-American Union, the international organisation and office maintained in Washington by the 21 American Republics, has been urging American aircraft manufacturers to take advantage of the open field in Latin America for aircraft " before your foreign rivals enter the field."

He emphasised the need for aeroplanes for South American exploration purposes, and referred to other commercial opportunities, if Americans would only send missions to study conditions and remove difficulties. He said European countries had already sent such missions, and were bending all their energies in that direction.

THE FLIGHT TO THE CAPE

AFTER covering four-fifths of the total distance from Cairo to the Cape, the "Silver Queen II" met the fate of all the other competitors for the honour of being the first to fly from Cairo to the Cape, and crashed. The machine was detained at Livingstone by exceptionally heavy rains for several days, but a start was finally made at 8.30 a.m. on March 5, and Bulawayo, 237 miles off, was reached at 12.55 p.m. Later in the day an attempt was made to start on a non-stop flight to Pretoria, but the machine crashed, and Col. van Ryneveld and Capt. Brand were slightly injured. From a telegram sent by Col. van Ryneveld to Messrs. Rolls-Royce, Ltd., it appears that the accident was due to taking-off with an overload at the high altitude of the aerodrome. The engines were working perfectly, and even after this second crash, they are still capable of completing the journey if a machine can be obtained to take them. The Union of South Africa has placed a D.H. 9 at the disposal of Col. van Ryneveld, and it is due to arrive at Bulawayo on Saturday next.

Of the other competitors, there is no further news to record, but the following summary by Dr. Chalmers Mitchell of the flight of *The Times* aeroplane will be found most interesting :—

Our actual flying time from Heliopolis to Tabora was 36½ hours for nearly 2,700 miles, which gives an average of about 75 m.p.h. With engines in normal condition this is an easy five days' journey, flying only from 6 a.m. until noon, with full comforts for travellers at night. The motion at worst is much better than at sea; when normal it is better than in a train. Writing, reading, and eating are more pleasant and the journey less tiring and quite suitable for private travellers.

The risk to life is extremely small with good pilots, even in case of a forced landing, but the risk to the machine is considerable, hence relays of machines are necessary for a passenger or commercial service. The risks of ascents are much greater, hence the enlargement of all elevated tropical aerodromes is imperative. A detailed survey of certain portions of the route is advisable for the purpose of fixing intermediate landmarks on account of varying winds and bad visibility due to bush fires.

The Vickers-Vimy planes, propellers, and controls gave no trouble. The passenger's seating, the position of the windows, and the accommodation of spare parts and food supplies require reconsideration. The morning cold makes a rug for the feet requisite, otherwise extra clothing is unnecessary. The existing arrangements for ventilation are sufficient, even during the great heat.

On our actual journey it was different. Success was achieved only by the skill of the pilots, the endurance of the mechanics, and the good fellowship of all five, coupled with the untiring aid of the Royal Air Force, British civilians, and natives. In our forced descent near Luxor the pilot was misled by the markings of a discarded aerodrome. The crash smashed my seat, but fortunately did no other damage.

Our first night was spent in the luxurious Cataract Hotel at Assuan, the future first stage of the permanent air route, but it is probable that a motor trolly will be required for transport to and from the aerodrome.

Sleeping in bags on the desert sand was comfortable. There were no mosquitoes, but the jackals were unnecessarily vocal. In the chilly morning we had breakfast off a billy of tea, toasted ham, and hard-boiled eggs.

Our forced descent at the good emergency aerodrome at Station Six for repairs necessitated a long wait in great heat. We saw our first mirage, and lunched off biscuits and tea out of a thermos flask. Our second forced descent that day was in a desert area which the pilots only found after an anxious search. The heat was extreme, and we had to wait hours while a native fetched water on a camel.

Khartum was reached after a most anxious trip (throughout which the water was leaking) just as the sun was setting. We enjoyed luxurious hospitality at Khartum, which is the normal second stop. After two nights at Khartum we had a forced descent on a good aerodrome at Jebelein for temporary repairs, then a second forced landing on dangerous ground near Renk. We were unable to reach water through the bush and swamps, so lunched on sandwiches and tea while obliging natives fetched water from the Nile.

We still hoped to continue our journey safely when the temporary repairs had been made.

The engines, on starting, leaked so badly that we resolved to return to Jebelein, and possibly to Khartum. During our stay of three nights at Jebelein, we experienced great kindness from District Inspector Bethel, and our short supplies were improved by shooting guinea fowl, while welcome drink was sent from Kosti. We should probably have abandoned the trip for lack of new engines, but knowing that none were to be had either in Khartum or Cairo, we resolved to persevere on the strength of my water-pumping invention. We certainly took an enormous risk in crossing the sudd, where a forced descent meant disaster.

A change of wind and bad visibility caused us to lose our way, and we had a forced descent on most dangerous ground in a burnt stretch of dry swamp in hostile Dinka territory. We ate a miserable meal of biscuits and tea amid terrific heat and the stench of dry swamp, which was nauseating.

Armed natives, hiding in the bush, did not approach us, and we could find no water, so made a flight in search of it. At last we found a creek near a similar burnt landing-ground, and had some amusing business with the armed Dinkas. We gambled on our direction, but when leaving Capt. Cockerell was unable to ascend from the bad ground, even after a run across the longest possible space available. On this the natives returned with bows, but our second attempt was happily successful after a further leak had been patched.

As daylight and petrol were both short, Capt. Cockerell, after a search, contrived to descend on a dry swamp at the edge of a Nile backwater, but the direction and distance of Mongalla were alike still uncertain. This was a pestilential landing-ground, abounding with mosquitoes, centipedes, crocodiles, and large bellowing animals. When it was dark natives brought firewood, milk and water. Either the stew was too much for us or our appetites failed us, and we supped on milk, quinine, and gin.

We dispatched a native with a note, hoping to acquaint Mongalla with our position, and fired rockets, but they only made a smoke. We tried to sleep on the planes, but in the morning there was no news, so after a breakfast of tea and biscuits, Capt. Broome and I started on a six hours' tramp through bush and swamp. We reached Mongalla quite exhausted, and found that our message had been received and that petrol had been sent by motor-launch.

We spent five nights at Mongalla, benefiting from kind hospitality, but all five of us were rather unwell, and the weather was most oppressive. Our first attempt at flight was a failure, and the return to the aerodrome was extremely dangerous. A magneto contact-breaker was broken and a radiator shutter jammed. Our second attempt, after repairs and after the radiator shutter had been fixed open, was successful.

We had a good trip to Nimule, where we had to descend on a rough aerodrome because of leakage, a damaged tail-control, and punctured tyres. Here lime-juice, milk, and firewood were kindly sent by a Syrian doctor. Cockerell said that his flying nerve was in danger for the first time in five years of flying, but we were all cheered by the mountain air and a luncheon of eggs and tea.

For dinner we had a stew of rice and bully beef, and tinned peaches. We spent a good night, although lions came roaring very close.

In an attempt to start in the terrific heat we could not rise above the Nile, but kept dropping almost to water level, and were forced to return to the aerodrome. There were columns of dust all round the horizon thousands of feet in height. At dusk we visited Nimule for dinner and a bath at the doctor's, and on returning to the aerodrome after dark every one had a good night.

After breakfast on tea and biscuits we had a good run to Jinja, where we slept in sleeping-bags in a temporary straw pavilion on the aerodrome for two nights in order to be ready for an early start. We experienced generous hospitality, and had motor drives to the club and some beautiful houses.

Our first attempt to start revealed fresh magneto trouble, and temporary repairs were effected in hopes that new engines would be awaiting us at Kisumu, to which we made a slow flight. The expected engines, however, turned out to be useless, as they had been left at Mombasa after a long immersion in salt water.

After two nights of luxurious hospitality we made a slow flight to Mwanza and Tabora, where we had further mechanical trouble, but every physical comfort

The final crash was due to leakage into the induction coils. This crash completed my confidence in the coolness, judgment, and skill of the pilots. Cockerell says the art of flying is to know how to crash. The occurrence is too rapid for alarm, but gives a great impression of the inevitable fragility of a costly machine, also a greater chance of safety for the passengers than a corresponding smash by road or rail.

REPORT ON THE JUNKER ARMOURED TWO-SEATER BIPLANE, TYPE J. 1

(*Continued from page* 265.)

Controls

A DIAGRAM of the Junker control system is given in Fig. 23, and serves to show how anxious the designer has been to avoid wires as far as possible. The duralumin control lever is forked at its lower extremity and pivoted to a short cross-piece. Through the triangle thus formed passes a longitudinal rocking shaft, to which the cross-piece is fixed by a short tube. The duralumin rocking shaft carries a steel sleeve to which is welded a light steel beam ending in a fork on each side. This constitutes part of the *aileron* control, which is worked by means of linked tubes, as in the Nieuport scout and the Halberstadt fighter. Tubes are carried up from the fork ends of the crossbeam to the ends of two shorter levers, one on each side, and vertical steel tubes pass up from these levers to the upper plane. Fig. 26 gives an fulcrum between the two ends, while the pivot of the starboard lever is at one end. The effect of this would be, of course, to cause both the *aileron* rods to travel in the same direction. Thus, if the joy stick were inclined to port, both rods would rise, while a starboard inclination of the lever would cause the rods to fall. It is not known whether this is found in all Junker J. 1 machines, nor by what means the movement is reversed on one side between controls and *ailerons*.

The Junker elevators are controlled by means of stranded cables attached to vertical levers, which are actuated by a steel tube direct from the control column. The extremities of the two vertical levers are not equidistant from the pivotal tube, but the upper part of each is appreciably greater than the corresponding lower part. It is found that the upper

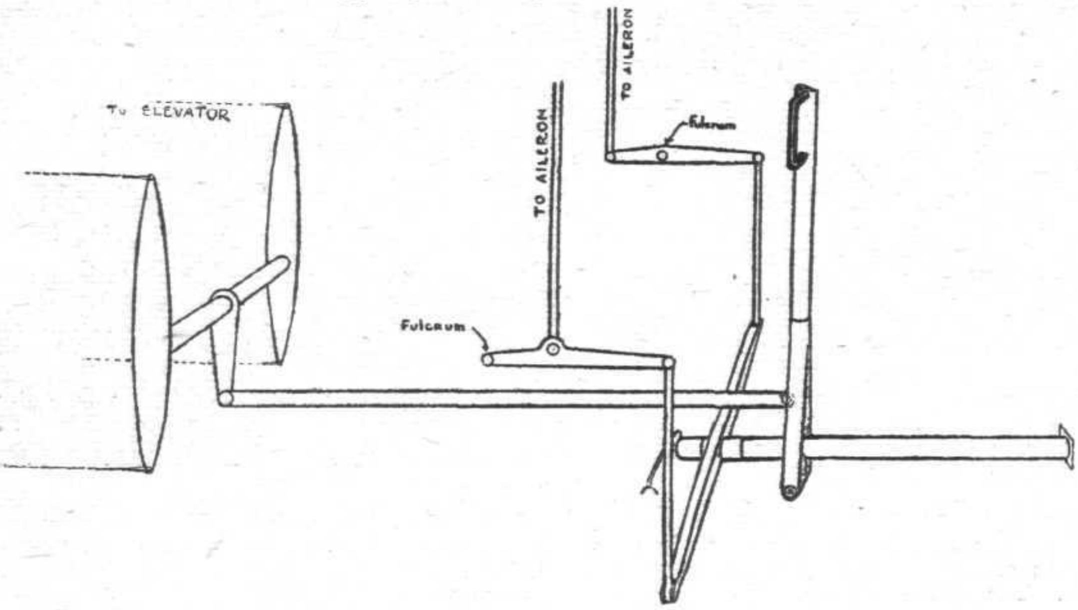


Fig. 23.—The Junker control system

excellent idea of the joy stick, and several of the photographs clearly show the vertical tubes passing from *fuselage* to upper wing.

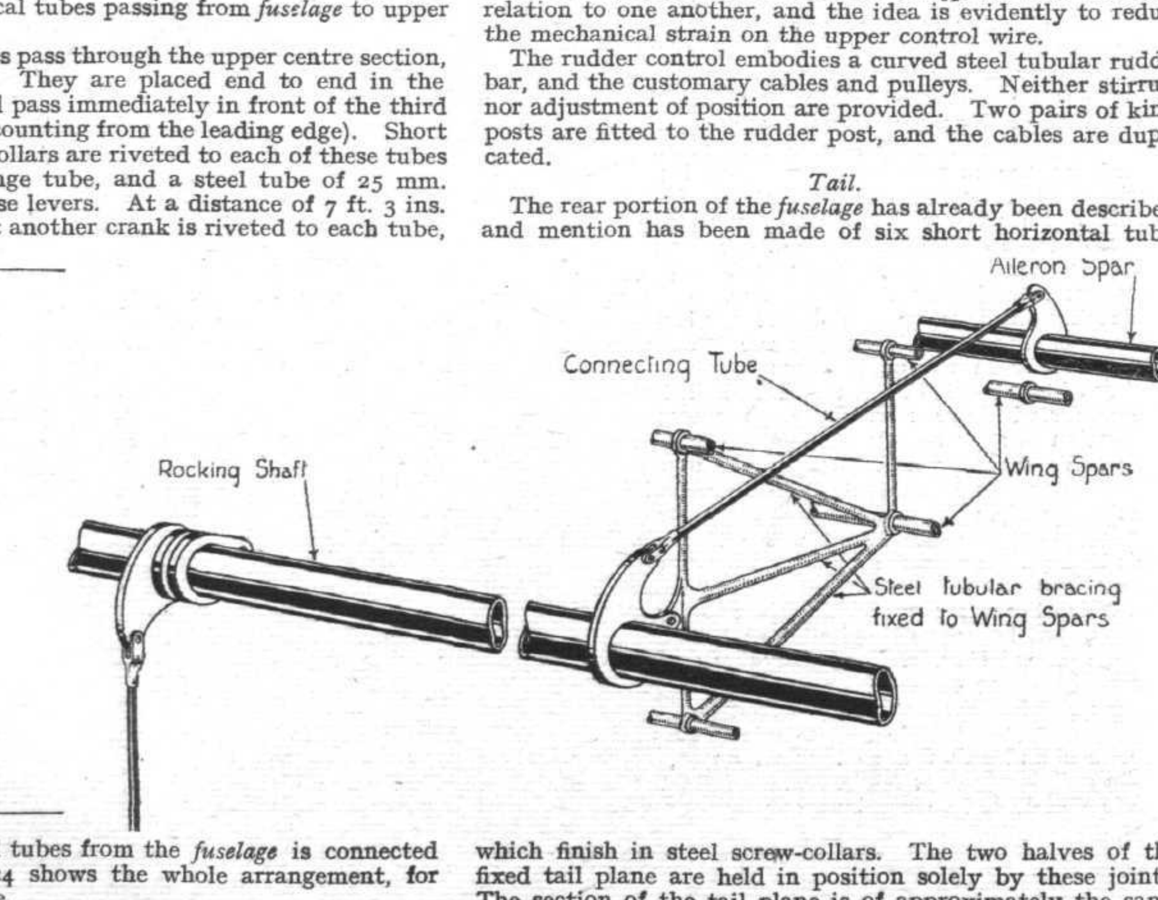
Two duralumin tubes pass through the upper centre section, parallel to the spars. They are placed end to end in the same straight line, and pass immediately in front of the third pair of tubular spars (counting from the leading edge). Short cranks fitted to steel collars are riveted to each of these tubes and to the *aileron* hinge tube, and a steel tube of 25 mm. diameter connects these levers. At a distance of 7 ft. 3 ins. from this arrangement another crank is riveted to each tube, and lower portions of the elevator kingposts bear the same relation to one another, and the idea is evidently to reduce the mechanical strain on the upper control wire.

The rudder control embodies a curved steel tubular rudder bar, and the customary cables and pulleys. Neither stirrups nor adjustment of position are provided. Two pairs of kingposts are fitted to the rudder post, and the cables are duplicated.

Tail.

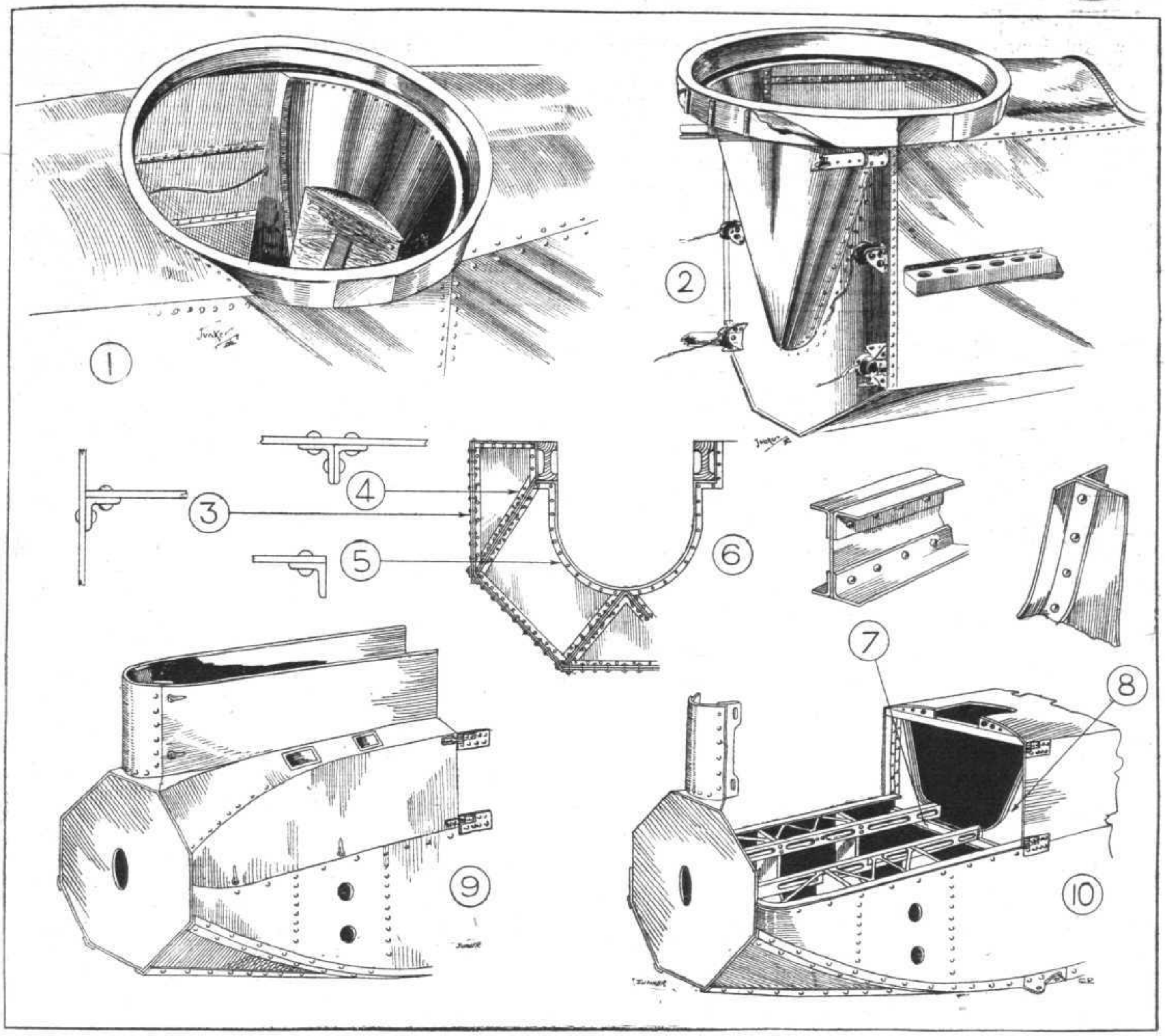
The rear portion of the *fuselage* has already been describees and mention has been made of six short horizontal tub

Fig. 24



and one of the vertical tubes from the *fuselage* is connected to this crank. Fig. 24 shows the whole arrangement, for one side, in perspective.

Examination of Fig. 23 will reveal the strange fact that the horizontal levers to which the *aileron* control rods are attached are not of the same order. The port side lever has the which finish in steel screw-collars. The two halves of the fixed tail plane are held in position solely by these joints. The section of the tail plane is of approximately the same shape as that of the wing. It contains seven tubular spars—one single tube in front, and three pairs at intervals behind, and the greatest depth is approximately $7\frac{1}{4}$ ins. The cover-



"Flight" Copyright

Fig. 25.—Details of the Junker J. 1 fuselage : 1 and 2. The rear (gunner's) cockpit. 3 to 6. Details of transverse bulkhead at engine bed. 7 to 10. Details of engine "housing"

ing is exactly similar to that of the wings, as also is the internal construction. The front spar is not fixed in any way to the *fuselage*, and the front foot or so of the tail plane simple abuts against the fabric.

The construction of the divided elevator is very simple. At the front is a duralumin tube hinged by the means shown in Fig. 27 to the rear edge of the tail plane. There are six such hinges altogether — three to each half of the elevator. The corrugated duralumin covering is riveted to the spar and is also held together at the rear edge by rivets.

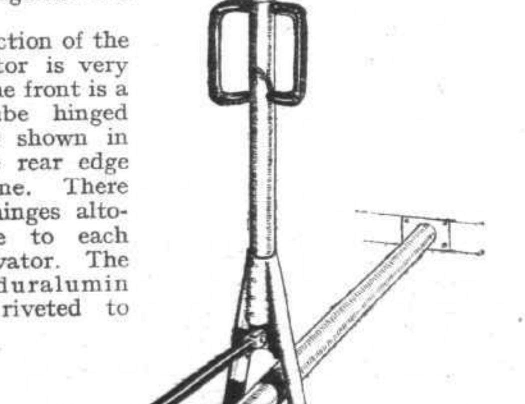


Fig. 26

The shapes of the fin and balanced rudder may be gathered from the scale drawings and the various photographs. There

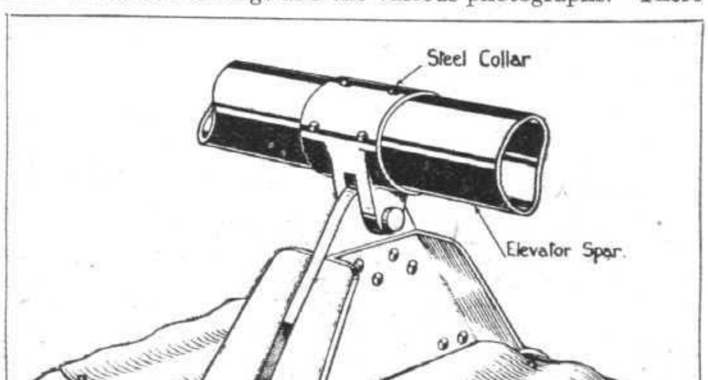


Fig. 27

are two tubular stays from the upper *longerons* to the apex of the fin. The rudder consists of a tube, a U-shaped leading edge of plain duralumin sheet, and two halves of corrugated duralumin, riveted together at the rear edge. The rudder depends for its strength, therefore, solely on the covering; and this is probably true of the fin also.

The tail skid is a substantial piece of ash bound with fabric, pivoted about its middle point, and fitted at the lower extremity with a welded steel shoe. The shock absorber consists of the usual steel coil spring. The four tubes which carry the tail skid are in the form of a pyramid, and are composed of steel. The fairing is of sheet steel welded on, which adds considerably to the strength of the structure.

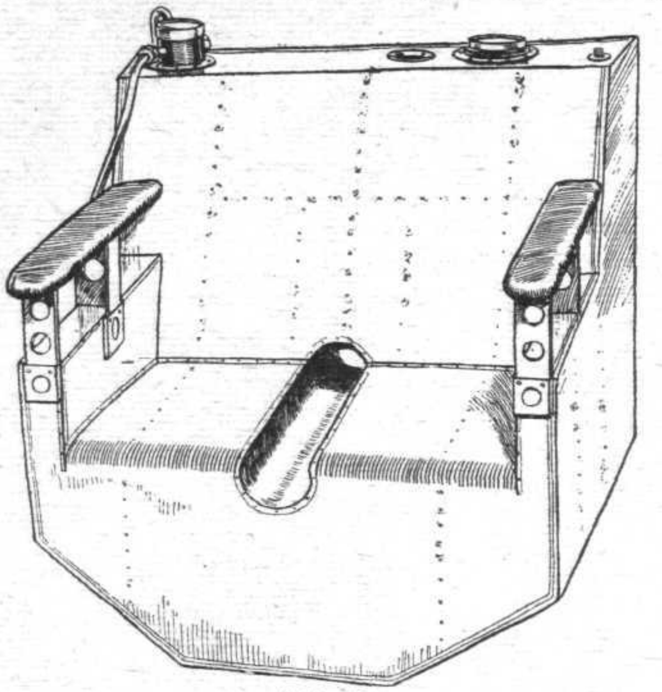


Fig. 28

Engine and Engine Mounting

The engine installed is 230 h.p. Benz, and it is remarkable that in such an all-metal type of machine the engine bearers are of ash. The bearers have sheet steel supports, and are braced to the side by means of duralumin tubes of 20 mm. diameter. Fig. 29 shows how this is done. The petrol tank is an elaborate structure of sheet brass. As shown in Fig. 28 it is built up into the form of an armchair, and is capable of carrying 26 gallons. The horizontal tunnel running from front to back accommodates the elevator control tube. Near the position of the pilot's right shoulder can be seen the top of the cylindrical pressure tank, which is part of the well-known Benz petrol system.

The oil tank is reported to have been carried just in front of the instrument board, and to have a capacity of 10 gallons.

Two different forms of exhaust pipes have been noticed, discharging above and in front of the upper plane; both types are frequently used with 230 h.p. Benz engines.

Radiator

A drawing of the radiator found with other damaged parts of the Junker biplane will be given next week. According to the evidence of the photographs it was fixed to the lower surface of the upper plane, over the rear part of the engine.

An aluminium box surrounds the radiator on all sides except front and rear, and the cooling effect is controlled by flaps hinged at their lower edge to the front and rear of the box. The setting of this elementary type of shutter could not be altered during flight.

Armament

It is known that no Spandau or other gun was fixed to be controlled by the pilot and to fire forward; also that the observer's gunring carried a Parabellum gun on the usual type of mounting.

No traces of guns fixed to fire downward were found on either of the machines examined, but it is known that many Junker biplanes carried two Parabellum guns immovably fixed in parallel positions on the left of the observer, firing downwards and forwards through holes in the *fuselage* armour and in the lower centre section. Other J. 1 Junker biplanes are known to have been fitted with wireless, but no machine has been known to carry both wireless and extra fixed guns.

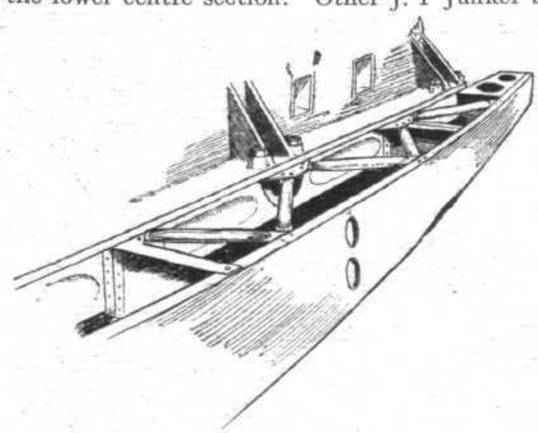


Fig. 29

Very lights were carried in an aluminium rack on the side of the *fuselage*.

Colouring

The machine is thinly painted in matt colours. The upper surface of the planes has irregular masses of the usual green and mauve tints, while the underside is painted a bluish-white colour. The struts and wheels are green, as is the armoured portion of the *fuselage*.

Instruments

None were salved. A circular well, which presumably accommodated the compass, may be seen in the photographs, in the starboard side of the lower centre section.

Table of Approximate Weights

	lbs.		lbs.
Upper centre section	198	One lower plane ..	63
One upper plane without *aileron*.	165	Main petrol tank ..	54
		Radiator	60
One *aileron*	$30\frac{1}{4}$		

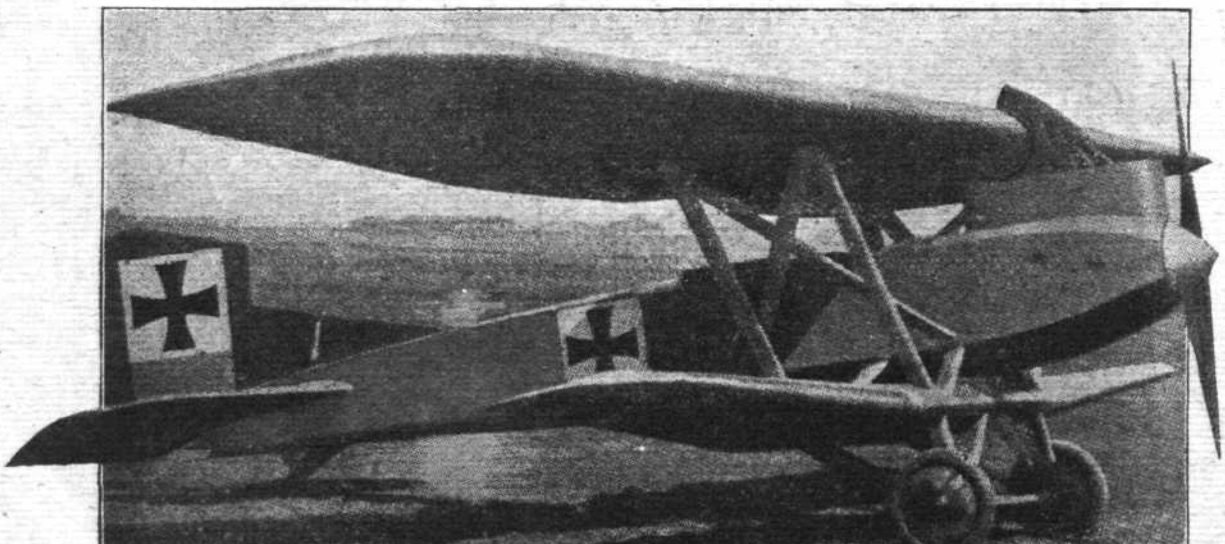


Fig. 30.—Three-quarter front view of the Junker J. 1

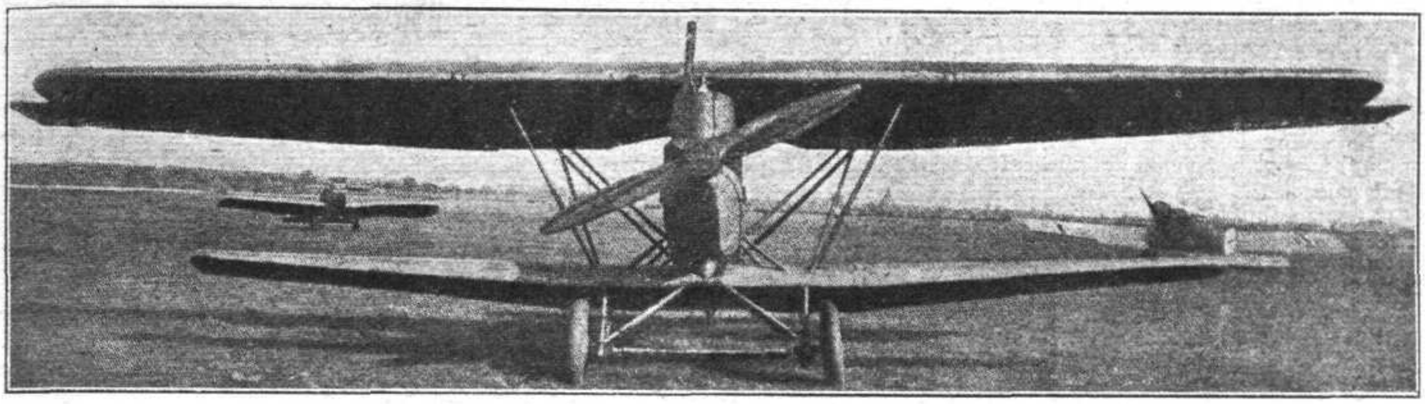


Fig. 31.—Front view of the Junker J. 1

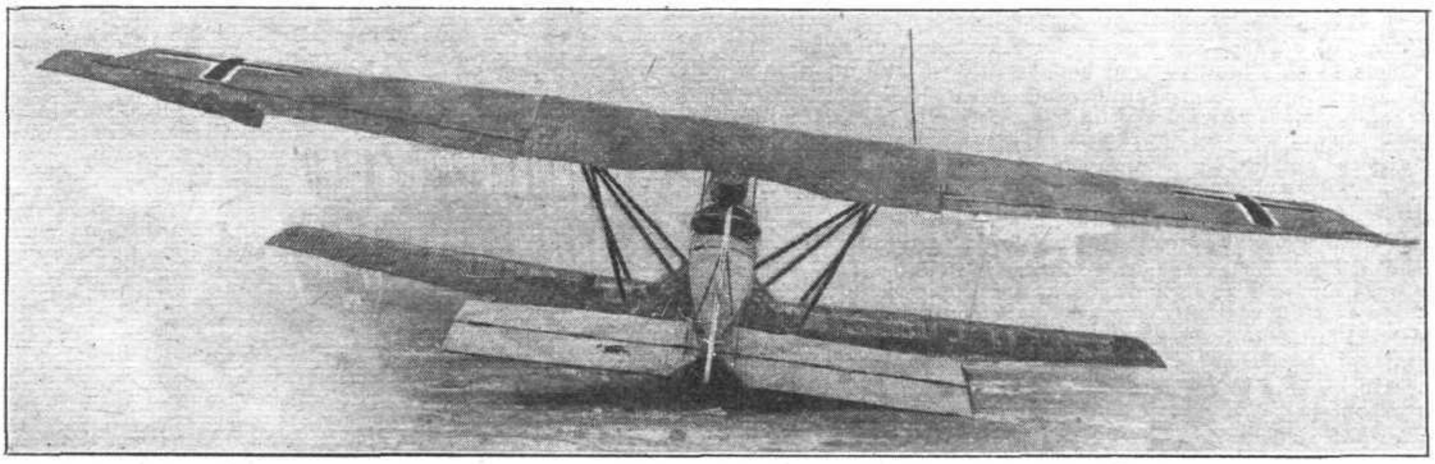


Fig. 32.—Rear view taken from a damaged Junker machine in Belgium

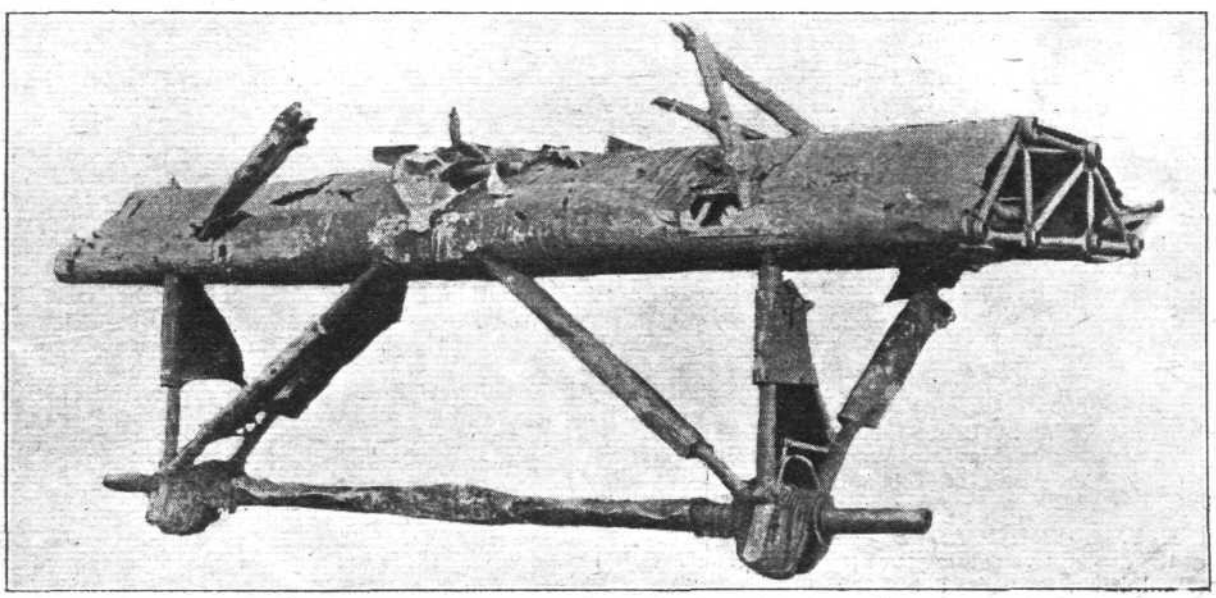


Fig. 33.—The Junker lower centre section-*cum*-undercarriage unit

(*To be continued.*)

The D F.W. Giant.

WE have received from the Controller General of Civil Aviation an interesting Memo. (No. 11) consisting of translations of articles on the German D.F.W. Giant machines from "Automobil-Flugwelt" and "Luftfahrt," together with reproductions of the illustrations. As much of the information contained in this Memo. has already appeared in FLIGHT ("The German D.F.W. Commercial Four-Engined Biplane") for Sept. 25th last, it only remains for us to place on record the publication of this Memo.

M.P.s Entertain "Old Carthusian's" Crew

AT the House of Commons on March 4, Major-General Seely, M.P., and Mr. Clement Edwards, M.P., entertained at luncheon the crew of the aeroplane "Old Carthusian," which flew from England to India. Major Maclaren, the pilot, and Flight-Sergeant Smith and Sergeant Crockett, mechanics, were present, and other guests included Lord Edmund Talbot, Mr. Whitley, Major Waring, Major Baird and Major Hamilton.

Mullion Old Boys' Reunion

WITH the object of arranging a reunion dinner some time during March or April, Mr. W. G. Lavender, 16, Alma Road, Wandsworth, S.W. 18, would like to hear from all demobilised officers, non-commissioned officers and men who served in the Airship Section of the Royal Naval Air Service, Mullion, Cornwall.

The Institute of Metals—May Lecture

AFTER the annual general meeting the next gathering of members will take place on June 10, 1920 (not on May 5, as previously announced), when Professor Carl A. F. Benedicks, Ph.D., of Stockholm, Sweden, will deliver the Tenth May Lecture, his subject being "Recent Progress in Thermo-Electricity." The place and time of the lecture will be announced later.

CORRESPONDENCE

[The Editor does not hold himself responsible for opinions expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for insertion in these columns.]

LIBERTY LEAGUE

[2002] We address you as representatives of a vast number of our countrymen upon a matter of vital importance to the nation.

An association has been formed under the title of the Liberty League, the object of which is to combat the advance of Bolshevism in the United Kingdom and throughout the Empire. Under various forms and names, and by dint of the most insidious propaganda—cleverly organised and plentifully supplied with funds—everywhere this abominable creed is being preached. We feel it our duty not to let it spread unchecked.

Bolshevism is the reverse of all that mankind has built up of good by nearly two thousand years of effort. It is the Sermon on the Mount writ backward. It has led to bloodshed and torture, rapine and destruction. It repudiates God, and would build its own throne upon the basest passions of mankind. There are some misguided people of righteous instincts in this country who believe in Bolshevism; there are others who have been influenced by secret funds; there are many who hope to fish in its bloodstained waters.

We, the undersigned, and those we represent, being assured that if it is allowed to conquer it will mean in the end the destruction of individual rights, the family, the nation, and the whole British Commonwealth, together with the handing over of all we hold sacred into the power of those foes who stand behind and perhaps have fashioned this monstrous organisation, appeal through you to the people of the Empire to aid in expelling its doctrines from their midst.

If this is to be done, as a preliminary step there must be counter-organisation and money at hand. The first we hope to be able to supply; the second we ask you to help us to obtain. We desire in a clean and open fashion to fight what we believe to be a great and terrible evil, by means of letting light into its dark places. We believe in the old adage—that the Truth is great and will prevail; but we believe also that this light should not be hid under a bushel. We are certain that at bottom the British workman is sound and upright, and that he does not desire to see in England, that ancient home of liberties, such conditions as prevail in Russia.

We ask you and all the Press and all right-minded men and women throughout the Empire, all too who profess any form of religious faith, or look onward to higher things, to help us in our effort. Your obedient servants,

H. RIDER HAGGARD
RUDYARD KIPLING
SYDENHAM
H. BAX-IRONSIDE
JOHN HANBURY WILLIAMS
ALGERNON MAUDSLAY
G. MAITLAND-EDWARDS

17, Bruton Street, Mayfair, W.

Donations to the Liberty League—the whole of which will be devoted to purposes of counter-Bolshevist propaganda—may be sent to the hon. organiser, Lieut.-Col. Maitland-Edwards, D.S.O., 17, Bruton Street, Mayfair, W., or to the National Provincial and Union Bank of England, Savoy Court, Strand, London.

SCIENTIFIC AND TECHNICAL BOOKS

[2003] One part of the descriptive catalogue of the British Scientific Products Exhibition, organised by the British Science Guild last year, was devoted to selected lists of books on science and technology.

The Guild has been asked to extend these lists, so as to include not only all branches of science—both biological and physical—but also the chief technical subjects. It has undertaken to do this; and a committee, of which I am chairman, has been appointed to prepare such a catalogue.

The lists will be limited to books of British origin actually in current catalogues of the publishers, so that they can be obtained in the usual way through booksellers. School-books and elementary manuals will not be included, and the general standard will be that of college courses in scientific and technical subjects, or of works' libraries. Each list will be submitted to authorities upon the subject with which it deals, but in order to secure that no important work is omitted, the Committee invites the assistance of everyone interested in its task. Such aid may be afforded by sending (to the British Science Guild, 6, John Street, Adelphi, London, W.C. 2) lists or single titles of British books of standard value or proved worth in any branch of science or industry. I shall much appreciate help of this kind which any of your readers may be able to give.

R. A. GREGORY

PARACHUTES

[2004] In his letter of February 26, Col. Holt states that my opinions would carry even greater weight were I not in the service of the Calthorpe Co. As my letter was an invitation to test my pulse-rate when making descents with different types of parachutes, I take it that Col. Holt does not imagine that my obligations to my employers could possibly affect my pulse-rate.

I challenged Col. Holt (who has already expressed his willingness to make a drop with his own parachute) or anyone else for that matter, to submit ourselves to psychological tests before making a descent with a Guardian Angel type and any other type parachute respectively.

I also challenged anyone to make a lower drop with any other type of parachute than we will with the Guardian Angel.

Throughout this correspondence, Col. Holt seems to have overlooked the fact that there are several makes of parachutes on the market in America which operate on the same principle as his auto-chute. They are all packed on the aviator's back in a knapsack kept closed by a clip and pin. The latter is extracted in mid air by tugging at a ring on one's chest, which forms the extremity of a short wire passing over the shoulder.

This is exactly the same method of release as the original French Robert "à dos" parachute. All these American types have a small pilot parachute. In two of them the pilot parachute has positive opening, but not the main parachute.

Five human drops have been made with one of them, but the free fall, after liberation of the pilot parachute, varied considerably.

On the fifth drop the parachute opened with the rigging lines tangled and fell about 400 ft. before it fully opened. The drops were made by Messrs. Irving, Floyd-Smith, Russell, Higgins and Sergt. Bottreill, all from 2,000 (two thousand) ft. with engine throttled.

Our challenge to drop at less than that height not being accepted, we dropped at 250 ft. at full speed in a Guardian Angel by way of comparison.

Personally, I would much rather jump at 150 ft. in a Guardian Angel than in a pilot parachute type at any height.

The idea of fumbling about for the ring and pulling it in mid air, is to my mind, too awful for words.

It is my opinion that comparatively few people would have the presence of mind and self-control to operate such a parachute without considerable premeditation. The risk of premature operation, before actually quitting the machine, is also very considerable. Lallemand was killed in this way at Villa Coublay, when making his second jump with a Robert parachute.

I know that in Col. Holt's system it is proposed to carry the pilot parachute in a wallet in front of the belt, but this seems to me even more objectionable psychologically than the Robert and American methods.

I would say that my effort has been to give my views with complete detachment from my business interests, and that neither this nor my previous letter have been in any way controlled or inspired by my employers, who realise the vital importance of placing humane interests before commercial considerations, and who, ever since I have known them, officially and commercially, have done so.

With regard to Col. Holt's remark that it does not seem to have occurred to any of your correspondents that it might be possible to introduce tangle-proof rigging into a free parachute of course, it is not only possible, but comparatively easy, but so far it has been done only in Guardian Angel parachutes. Col. Holt says no one in his senses disputes its necessity, then why is it that neither he nor any other inventor, except Col. Blackburn, has incorporated it in their specifications or products.

The suction question is easily disposed of by sealing the vent with either a rupturable piece of paper internally or an elastic band externally; but it does not matter how well the vent is sealed, the mouth must be open before the air can get into it and without positive opening there is no positive certainty that the mouth will open either early or late, or at all.

March 3. T. ORDE LEES

ROYAL AERONAUTICAL SOCIETY NOTICES

Lectures.—Col. the Master of Sempill, A.F.C., will take the chair on the occasion of Maj. C. F. Abell's lecture on "Airship Machinery, Past Experience and Future Requirements," commencing at 8 p.m. on Wednesday, March 17, at the Royal Society of Arts, John Street, Adelphi, W.C. 2.

The next lecture will take place on Wednesday evening, April 14, when Maj.-Gen. Sir W. Sefton Brancker, K.C.B., A.F.C., will read a paper. The chair will be taken by Maj. G. C. Tryon, Under-Secretary of State for Air, at 8 p.m. at the Royal Society of Arts.

Annual General Meeting.—Notices of resolutions which members may desire to move at the Annual General Meeting should be received by the Secretary not later than noon on Tuesday, March 16. Nominations of candidates for election to the Council, accompanied by a signification of willingness to serve, must be received not later than noon on Tuesday, March 9.

Annual Reports and Journals.—The following numbers of the early "Annual Reports" of the Society and of the *Journal* are missing from those available for sale. The Secretary would be glad to hear from any Members who may have copies for disposal. Annual Reports for the years:—1866, 1867, 1874, 1883, 1884. Copies of the *Journal* for October, November, December, 1918, and January, 1919.

The Library is now open for the use of Members, including Saturdays from 9.30 to 5 p.m.

Student's Meetings.—Suggestions have been received that it would be of interest to Student Members to arrange periodical informal meetings for discussion in the Society's Library. The Secretary would be glad to hear from any Students interested in this suggestion.

W. LOCKWOOD MARSH,
7, Albemarle Street, W.1. Secretary.

CAMBRIDGE UNIVERSITY AERONAUTICAL SOCIETY

THE fifth meeting of the Society was held in the Engineering Laboratories on Wednesday, March 3, at 8.30 p.m., Mr. H. A. Mettam being in the chair, when a lecture was given by Mr. G. I. Taylor, M.A., F.R.S., F.R.Ae.S., Fellow of Trinity College, on "Aeronautical Experiments, 1914-15."

Prior to the delivery of the lecture, a short business meeting was held to elect officers for the year 1920-21. Mr. H. A. Mettam, A.F.R.Ae.S., was elected President, and Mr. O. E. Simmonds was re-elected Secretary. The following members were elected to serve on the Committee:—Miss Chitty, A.F.R.Ae.S. (Newnham); Mr. I. A. J. Duff (Trinity Hall); Mr. C. G. Funnell (Sidney), Mr. R. T. Goodyear (Clare) and Mr. R. K. Muir (St. Catharine's).

Mr. Taylor said that he intended to give a brief outline of the work of "the odd jobs" department at the Royal Aircraft Establishment during the first two years of the War. He did not feel an apology was needed for the lecture, as what he intended to relate had not been previously published. Mr. Taylor then gave details of experiments which from time to time had been conducted at the R.A.E., and the humorous side of the work did not suffer in the least degree by the lecturer's treatment. He told tales of Pyestock chimney and the darts he was wont to drop from its top, of legs of mutton and ballistic pendulums used to test the force and penetration of the darts, and of cavalry officers who when they saw darts recently dropped from an aeroplane on the aerodrome, praised the fine shooting and waxed incredulous. Thousands of darts, he said, were sent overseas to the R.F.C., but were not used because they were deemed "inhumane and contrary to the uses of civilised warfare." Mr. Taylor then continued: "Gunpowder was deemed respectable on account of its long usage, but the force of gravity was inhumane and disreputable. Still, if used in conjunction with gunpowder, as in a howitzer, it was to be tolerated."

The lecturer spoke of the early B.E. and F.E. machines, and of various experimental tests upon them, and closed by discussing the trailing of bombs from aeroplanes as a means of destroying airships.

The Bombay-Karachi Aerial Mail

IN connection with the discontinuance of the Bombay-Karachi air mail service the *Times of India* points out that the total loss on seven return journeys was Rs. 60,000 (£4,000).

London Anti-Aircraft Stations

THE London County Council has been informed by the War Department that orders have been issued for the clearance of all anti-aircraft stations. The present position in the metropolitan area is as follows:—The stations at Archbishop's Park, Battersea Park, Blackheath, Bostall Heath, Clapham Common, Clissold Park, Deptford Park, Eaglesfield, Finsbury Park, Hainault Forest, Hampstead Heath, Highbury Fields, Meath Gardens, Parliament Hill, Ruskin Park, Streatham Common, Victoria Park, Wandsworth Common, and Wormwood Scrubbs have been dismantled and cleared of buildings, except in the case of Eaglesfield, where the huts and fence remain. Concrete work and *débris* still remain in every case. The station at Plumstead Common is being used as a stores depôt.

Alteration to Air Navigation Acts

THE Air Ministry has issued the following Notice to Airmen (No. 21):—

"Amendments have been made to the Air Navigation Regulations, 1919, whereby Rule 10 (1) of Schedule VIII now reads:—

"'Every pilot of an aircraft departing from the United Kingdom shall,' etc., etc., instead of 'Every pilot of an aircraft carrying goods to any place outside the United Kingdom shall,' etc., etc.

"Rule 10 (2) of Schedule VIII has been amended to read 'No pilot shall depart in any aircraft from the United Kingdom,' etc., etc., instead of 'No pilot shall depart in any such aircraft from the United Kingdom,' etc., etc."

Opening of Croydon Aerodrome

THE Air Ministry has issued the following Notice to Airmen (No. 22):—

"Directions have been issued by the Secretary of State for Air amending Schedule 8, paragraph 1 (1) of the Air Navigation Regulations, 1919, by which from March 28, 1920, Croydon, Surrey, becomes an appointed aerodrome and Hounslow, Middlesex, is given up."

This means that Croydon takes the place of Hounslow as the official air terminus for London.

Prices of Aviation Spirit to Civilian Aviators

THE Air Ministry has issued the following Notice to Airmen (No. 23):—

"The following prices for aviation spirit and lubricating oils issued at Government-owned aerodromes to civil aviation pilots are now in operation:—

	Per gall., exclusive of container	
	s.	d.
Aviation petrol (if tins are taken away, 3s. per tin will be charged)	3	8
Motor spirit, grade 1	3	8
Motor spirit, grade 2	3	7
Motor spirit, grade 3	3	6
Castrol R. lubrication oil	10	3
Oil, mineral, thick....	4	8
Oil, mineral, thick	4	8
Castor oil, pure pharmaceutical	9	5
Castor oil, treated	9	7

"No issue of aviation spirit will be made unless the commanding officer of the issuing unit is satisfied the spirit is intended solely for flying purposes. Motor spirit will be issued only in the case of utmost urgency."

Aerial Lighthouse at Lille

THE Air Ministry has issued the following Notice to Airmen (No. 24):—

"In order to assist pilots flying on the route from France to Belgium *via* Valenciennes, a flashing lighthouse has been installed at Lille aerodrome, which is situated two miles south-east of Lille in approximately lat. 50-37 N. Long. 13-6 E. of Greenwich.

"The lighthouse is in operation every evening from sunset to 8.30 p.m., and later if required. The signal flashed is a Morse code letter A (dot dash) every eight seconds."

AIRISMS FROM THE FOUR WINDS

No more far-seeing man exists in practical affairs of life than M. Michelin, who has been elected President of the Aero Club of France and he is very optimistic in regard to the future of air-travel. In fact he visualises that in a short period—say, 1925 or so—the normal speed of aeroplanes will be round about 250 m.p.h. To a certain extent M. Michelin's estimate is influenced by the recent inventions of M. Rateau, the French scientist, whose mind is set in the direction of an air-turbine. This he claims will "permit flight at a very great height by compressing the air necessary for the working of the motor, and, of course, incidentally, for the lungs of the pilot and passengers." Which sounds like a very airy proposition, and we hope M. Michelin's optimism is based upon some more tangible basis than this. But M. Rateau is not alone in France in go-aheadness, apparently, as another distinguished engineer claims to be able to construct an aeroplane fitted with motors totalling to 50,000 h.p. with which it will be but an ordinary flip to leave Paris after breakfast, lunch at Naples and be in time to change for dinner at Cairo. We are getting on.

- - -

IN regard to the recent air-mail experiment in India, its failure has apparently caused little surprise amongst those out there competent to judge. Most folk it is said felt at the beginning that an aerial mail from Bombay to Karachi was not a test which would prove anything. On the first voyage the aeroplane carried 48 lbs. of mail; on the second this dropped to 13 lbs.; and on the third there was an accident which delayed the machine. Since then, people, both in Bombay and Karachi, seem to have taken no interest in the experiment, which should have continued till the moonsoon in June, but has been abandoned after a little over a month's trial.

- - -

THE journey by aeroplane of the Premier of New South Wales, Mr. A. W. Holman, was highly successful. During his rapid 700 mile tour of the State he was able to carry out his programme of addressing 20 meetings in a fraction of the time it would have occupied by any other means of transport.

- - -

ITALY it is reported has entered the list for the Gordon Bennett Aviation Cup Competition.

- - -

WE noted recently that the London-Paris Air Service had this year taken its place in the "A.B.C." time-table. This amplified entry in March reads as follows:—

Air Route from Hounslow Aerodrome to Le Bourget Aerodrome, 250 miles. Fares £21. R.T., double fare. Free conveyance by motor to Hounslow from any point within one mile of Piccadilly Circus; also between Le Bourget and Paris, and *vice versa*.

The above fares are not subject to the 50 per cent. increase. Subject to special passport regulations.

	Hounslow.		Le Bourget.	Le Bourget.		Hounslow.
P.M.	12.30	..	.. 2.45 ..	P.M. 12.30	..	2.45

No Sunday Service.

Further particulars, see cover, p. 5. Aircraft Transport and Travel, Ltd.

- - -

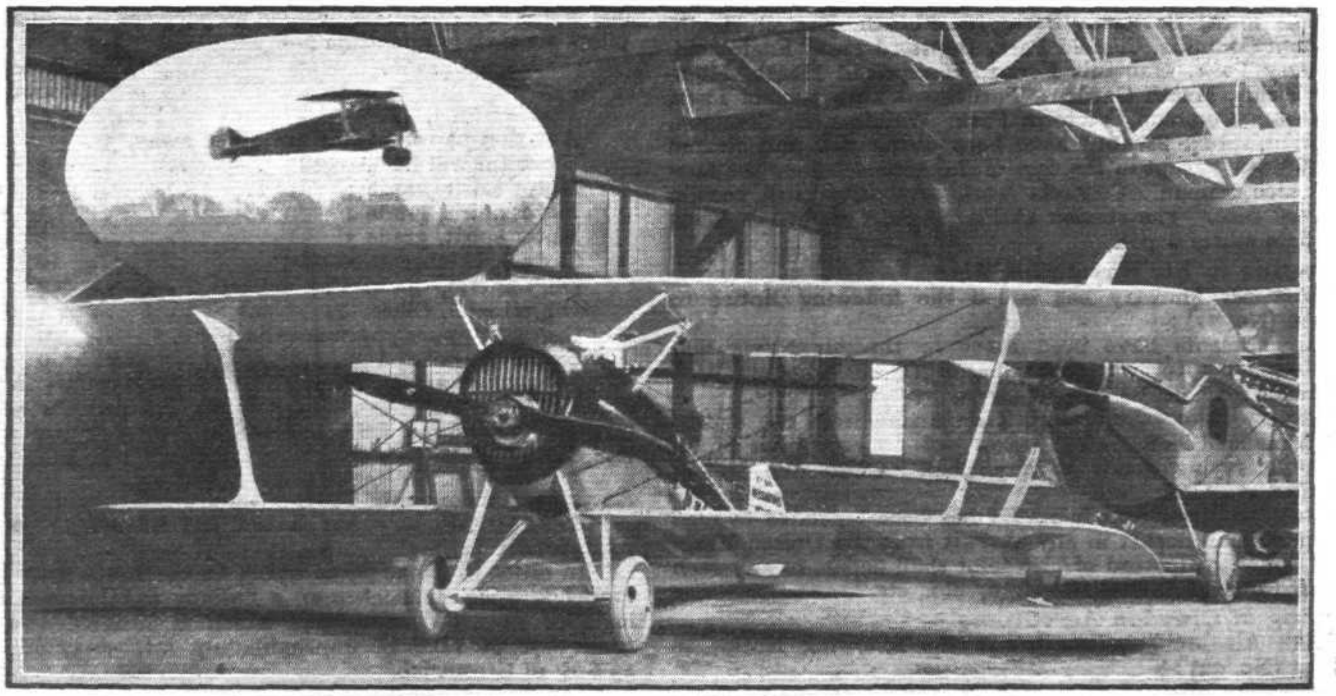
NO doubt in time this air item will be extended. It cannot help but come about when one has to record almost unnoticed flights such as last week's Nice to London trip, a distance of 900 miles, under 9 hours, the actual flying time being 7 hours 7 minutes, accomplished, with a passenger, by Messrs. F. L. Barnard and H. W. Chattaway, pilots in Messrs. S. Instone and Co.'s passenger service. Leaving Nice at 7 a.m., they had landed at Hounslow by 3.45 p.m.

- - -

IN a totally different direction pronounced success is said to have resulted from the establishing of a France-Morocco airline of communication between Toulouse and Rabat, *via* the East Coast of Spain. This started operations about six months back, under the protecting wing of the French Government, and in Madrid circles the success has created a profound impression. No doubt, it is costing a bit, but at this stage that is inevitable. The company concerned has since the opening trip on September 1 regularly carried out the postal service with which it is entrusted over a total flight mileage measuring six times the distance round the world, without accident to passengers or pilot. Considering that the service has been working during the worst season of the year, and includes the Pyrenees to be coasted, the firm may be pardoned the ring of pride in the voice of the manager of their Madrid office when he gave a *Times* correspondent this information.

- - -

EIGHT voyages are made each month in either direction. The aeroplane, fitted with 250-h.p. Renault engines, wing span 38 ft., length 23 ft., capable of carrying two passengers and of lifting half a ton weight besides the pilot and five and a half hours' provision of petrol, leaves Toulouse at 9 a.m., arrives at Barcelona in time for luncheon, and at Alicante for dinner and bed. The following day Malaga supplies the luncheon, and Rabat is reached about 4.30 p.m. The total distance is 1,125 miles, and the scheduled time of flight 14 hours. The average in practice has worked out at about 11 hours.



"Spad 27," the Messageries Aeriennes Co.'s 'bus piloted by Lieut. Jean Casale, which brought over mails from Paris on Thursday last week. Inset, Lieut. Casale taking off at Hounslow on Friday for Paris

LIEUT. JEAN CASALE, THE PILOT OF "SPAD 27": This French Ace, during the War brought down 12 machines, gaining the Legion d'Honneur, Medaille Militaire (nine palms), and D.S.O. Lieut. Casale has recently put up three fine records, viz.: height, 9,520 metres (solo); height, 7,300 metres (two passengers); and speed, 288 k.p.h.

The secret of the regularity of the service is perhaps that the distances are well within the power of the craft employed, the route is extraordinarily well defined (it follows the coast line most of the way), and the landing grounds are good. Besides the regular stages, landing places have been spotted every 30 miles or so along the route. The volume of traffic is at present greater from Morocco to France than outward bound.

This service is a good illustration of the value and necessity for perfect organisation to inspire confidence.

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MR. JOSEPHUS DANIELS, the aggressive U.S. Secretary for the Navy, is all out for an almighty big fleet, failing a strong League of Nations. In his estimate for the U.S. Navy if the League of Nations materialises, with the United States in its fold, he includes four aeroplane-carriers. If no League of Nations then follows his all-conquering fleet. Although Mr. Daniels is a believer in embodying aviation in his programme of offence and defence, he is not over-wrought with enthusiasm as to its paramount importance. His views upon this particular part of his scheme, as given to an interviewer are, to start with, that it is disgraceful that America should lag behind other countries in aviation, which originated in America.

He asks for an up-to-date air service, but, speaking as Secretary of an office closely corresponding with that of the First Lord of the Admiralty in England, he claims the idea that capital ships would soon be at the mercy of aircraft was not shared by America's responsible officials. "This is by no means the first time we have seen such propaganda," said Mr. Daniels. "Thirty or forty years ago, with the development of torpedo craft, there were many who believed that the day of the capital ship had passed. Twenty years ago, with the genesis of the submarine, there were similar claims for this new weapon, yet in the world-war the capital ship still was the backbone of the Fleet which dominated the situation afloat, and lacking which the Allies would surely have lost."

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POSSIBLY, but *without* aircraft Mr. Daniels, if he enquires carefully, will find that civilisation would have in all probability gone down before the Huns, which would then have really given the Americans a chance of demonstrating without equivocation how they won the War.

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NOBODY has realised this better than the Germans themselves. By way of a timely warning in this connection comes a report given by Col. W. N. Hensley, the American military observer on the return voyage of our R. 34, after five months' aeronautical observation in Germany. He claims that at present only two countries in Europe have gone back to work. One is Germany and the other is Belgium. He appears to be amazed at the stupendous efforts by Germany towards rehabilitation. Writing in regard to aviation, the Colonel says:—I was specially interested in aeronautics, and learned some things that amazed me. The Germans are going into aeronautics with tremendous determination, and are building metal 'planes with capacity for 28 passengers.

But, no doubt, Germany has an eye to the military side of aviation. I discovered why the Germans were acquiescent in surrendering their warships. The reason is that in the minds of the many the day of sea-fighting is over. German opinion holds that the wars of the future will be settled in the air combats and in conflicts between armadas of aeroplanes and armoured dirigibles. That is what they are working and planning for.

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AGAIN, how is it, under the conditions of the Peace Treaty, that Germany is permitted to be building all these aircraft? It is a clear case of flouting the terms and forestalling them by four to six months by the construction in advance of these craft under their air-supremacy programme.

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IT looks as if *our* estimates should in this case be overhauled and in a not very distant future.

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ANOTHER instance of 'planes filling the gap, during the long drawn out preliminaries for getting a railway going in out-of-the-way districts, is set out in a recent communication from a correspondent in *The Times*, writing from Tangiers. The country appears to be *very* alive and go-ahead, as may be gathered from the opening lines of the correspondent, as follows:—"To one who has not been in Morocco since the French Protectorate was declared in 1912 the change, even in the International Zone of Tangier, is marvellous.

"Where formerly there was not a single wheeled vehicle nor road, and where we all, including ladies, used to go out to dinner on horseback or donkeyback (not to mention the single famous sedan chair), there are now excellent roads in every direction, and cabs and motor cars abound," and so on and so on.

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AFTER dealing with various phases of the advancing state of affairs in the country he continues:—

"As for the Tangier-Fez railway, officers of the Spanish R.E. have been studying the question for some years, and the matter has got as far as being 'adjudicated.' But that does not mean that it is likely soon to see the light. The offices have been unable, so far, to make up their minds as to the exact trace, and have changed it more than once—and there the matter rests.

"Meanwhile, aeroplanes have something to say in the matter, and besides the present twice-a-week service from Toulouse *via* Tangier to Rabat, a daily service between the two last-mentioned towns is going to be inaugurated, by French enterprise, on March 1."

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AN interesting note is to hand from a subscriber in Seattle, Wash., U.S.A. He writes:—"I am glad to say that in the last three years I have received my issues of FLIGHT with greater regularity than I have the contemporaries published in this country. I also feel that the large extent to which your articles are republished in the technical and non-technical magazines over here, is a tribute to the worth of your weekly." Passing on to the prospects of aircraft in his district he continues:—

"The next few years should see great advances made in aviation in this part of the country, which is in the midst of the greatest spruce belt of the world, extending from Southern Alaska through the entire length of British Columbia, Washington, Oregon, to northern California.

"If the proposed aerial Derby to Alaska takes place this spring, there should be good openings for flying boats, as they seem to be most suited for forestry patrol and aerial mail service, owing to the large number of lakes and inlets on the coast.

"The people here do not appreciate the worth of the aeroplane as much as they would if they were in closer contact with it. Those of us who have unlimited faith in aviation must, for the time being, rely entirely on such magazines as FLIGHT to keep abreast of the times."

FLYING OVER CLOUDS IN RELATION TO COMMERCIAL AERONAUTICS

A PAPER under the above title was read by Professor B. Melville Jones on March 3 before the Royal Aeronautical Society. We regret that lack of space prevents publication of the paper *in extenso*, but it is hoped that the following brief *résumé* will be found to contain all the essential points made during a very interesting lecture.

After pointing out the unfavourable situation of this country, far from the universal junction of air routes, Egypt, and its bad weather conditions, the lecturer mentioned that in the future the nation that is disadvantageously placed aerially will be much in the same position as the unfortunate nations which had bad seaports when sea traffic was becoming an important factor in international trade. He then expressed the opinion that we in this country should push along to the utmost every method of science and organisation which will help to reduce our natural handicap. Other nations which are more favourably placed have nothing to gain by improvements in bad weather flying; on the contrary, it is to their advantage that no progress should be made in this direction, but it is up to us to develop this side of flying to the utmost, thereby reducing the handicap which Nature has imposed upon these islands.

Professor Melville Jones said that he would not deal with the question of flying in a fog, since at present this was quite beyond us. He did not think this would always be so, but at present there was no known method of landing safely in a fog on anything but an indefinitely large aerodrome. The lecturer dealt with the problems of bad weather flying under two main headings—under-cloud and over-cloud flying. He expressed himself as an advocate of the latter, as being more likely to give reliability, although he admitted that it would require a large and very complete organisation.

Each of the two forms of flying had its own peculiarities, which were summarised as follows :—

"1. Under-cloud flying can be successfully performed commercially by individual effort, but will always be at a serious disadvantage compared with fine weather flying.

"2. Over-cloud flying can *only* be engaged in *commercially* with the assistance of organisation on a large scale, and with certain apparatus, additional to what is essential for fine weather; given these conditions, however, it is capable of development to such an extent that it is very little inferior to fine weather flying as a commercial proposition.

"3. Individual effort, unless assisted by far-seeing organisation on a large scale, is liable, of necessity, to develop under-cloud commercial flying at the expense of the alternative method, although the latter is likely to achieve better results in the long run."

The objections to under-cloud flying were classified as follows —1. Strain to pilot. 2. Danger of collision. 3. Discomfort to passengers and pilot. 4. Loss of power to use favourable winds. 5. Annoyance to people on the ground. 6. Danger in forced landings. The lecturer then proceeded to deal with these in detail. The strain to the pilots when flying low on days with bad visibility was very great, not only on account of the continuous watchfulness necessary, but also because of bumps, which were more pronounced at low than at high altitudes. The danger of collision when flying low under clouds was not serious at present except in the neighbourhood of aerodromes, but would, in the opinion of the lecturer, become so when the air became more crowded. With regard to the discomfort to the occupants of a machine flying low, the lecturer compared a flight under these conditions to a rough Channel crossing, whereas when flying over clouds there is a feeling of exhilaration, and the pleasure of seeing the blue sky above and the white clouds below must be experienced to be appreciated. With regard to the power of choosing height so as to utilise favourable winds, the lecturer pointed out the advantage enjoyed by the pilot flying high. The dangers of forced landing when flying low were that the engine might fail as one was flying down-wind, which would necessitate a turn into the wind, accompanied by a loss of precious height. On the other hand, flying low had this advantage, that one generally had a good idea of the lie of the land at the moment the engine failed. This was not the case when flying above the clouds, but one then has two balancing advantages: there was time to consider possible trivial causes of failure and to remedy them, and if the pilot knew the wind direction near the ground he should arrive through the clouds already flying up wind.

The lecturer then turned to a discussion of the difficulties of over-cloud flying, and developed his second argument that over-cloud flying can *only* be done *commercially* with the assistance of a large organisation. The difficulties attending this class of flying were enumerated as follows :—1. Difficulty of actual in-cloud flying. 2. Danger that the clouds may come to the ground whilst aeroplane is in or above them. 3. Difficulty of navigation. 4. Difficulty of aerodrome finding at end of flight. 5. Danger of collision in clouds. 6. Possibility of having to reach great heights to clear clouds. 7. Danger from storm clouds.

The first difficulty could, the lecturer said, for the purposes of his argument, be dismissed in the following words :—"Flying in clouds, although requiring special apparatus and training of a simple kind, presents a problem that has already been completely overcome." At first he thought of dismissing it in this way for the sake of brevity, but he then decided that it would be a favourable opportunity to discuss the reasons that make cloud flying difficult, and the methods by which the difficulties can be overcome. The essence of difficulty of flying in clouds lies in the fact that it is impossible to distinguish between the effects of gravity and of acceleration. This is of no importance when a trained pilot is flying in the open, because he then preserves his idea of the vertical by looking at the horizon. In a cloud, however, it is quite a different matter, the pilot having then no datum line by which to judge the attitude of his machine. The lecturer then went on to explain the happenings that usually befall a pilot who is unequipped for cloud flying. The lecturer then dealt with the peculiarity of compasses in swinging towards the inside of the curve when turning, and pointed out why, when flying south, this was rather an advantage, whereas when flying north it was a great drawback. The three main types of cloud flying instruments, the static head turn indicator, the spinning top, and the Gyro turn indicator, were next explained. Concluding this section of the paper the lecturer said he thought it possible to state quite definitely that, whilst cloud flying without special instruments is difficult and dangerous, there are three distinct and tried forms of apparatus that make it feasible, and one at least of these, the Gyro turn indicator, makes cloud flying practically as safe as open air flying. Turning from the actual passage through the cloud, the lecturer came to the most serious difficulty of all, the danger that while the aeroplane is above or in the clouds these have come down to the ground. On this point the lecturer expressed the opinion that the only counter for this danger is the use of the wireless telephone, together with an organisation that keeps the pilot informed of the state of the air under the clouds during almost the whole flight. The lecturer thought that no other means of communication than direct speech on the telephone would prove adequate, owing to the complicated ideas that may have to be conveyed. He imagined that the organisation for an air route with wireless communication would include a train of small wireless stations along the route of which at least one would be in wireless communication with the aeroplane during the whole flight, and which would be linked up by wire to the Meteorological Office, and to the aerodromes along the route.

The difficulties of navigation above the clouds were then outlined by the lecturer, who placed the different methods available under four main headings :—1. Dead reckoning; 2. Observation of heavenly bodies. 3. By direct observation of fixed balloons or Archie bursts. 4. By the help of wireless. The first of these methods, the lecturer thought, was not suitable for distances greater than about 100 miles. The second looks very promising for very long voyages, but is too cumbersome for relatively short flights. By the use of observation points, such as balloons or archies there is the great disadvantage, in the case of the former, of a horrible wire passing up through the clouds, and with the latter there is a heavy shell which has to be got up through the cloud and brought down to earth again without hitting anything. The remaining way is the use of wireless, and this was the one which the lecturer considered most promising. Four ways of using wireless were indicated :—1. With large central stations, not necessarily on the route, receiving signals directionally from the aircraft and themselves working out its position and transmitting back to the aircraft. 2. With large beacon stations whose messages are received directionally, the position being worked out on board. 3. With small beacon stations on the route whose signals are received directionally by the aircraft with a fixed apparatus that allows the pilot to fly straight on the beacon, and 4. With small direction receiving stations near the route that receive the aeroplane signals directionally and instruct the aeroplane

accordingly. Of these the lecturer thought the last to be most likely to give good results generally.

The lecturer then outlined a system of navigation coming under the fourth head. "Imagine," he said, "a much-frequented trade route, say from London to Paris, or London to Scotland or Ireland, and suppose that at the termini and at distances of say 100 miles there were stations equipped with wireless telephones and directional receiving sets; suppose also that the aircraft are equipped only with the wireless telephone transmitter and receiver. The course of a flight might be as follows :—

"The aircraft starts from London with the best available information as to wind above clouds and state of air below clouds along the route. The pilot immediately passes up through the clouds on the best course he can lay to get him to the first wireless station, say Folkestone. Let us imagine that his dead reckoning would have brought him within 15 miles to the west of Folkestone, although of course he does not know this. When about 20 miles or more short of Folkestone, by his calculations, he calls up on his 'phone and asks for his bearings. Two alternative procedures are now possible. In the first the operator at Folkestone gives the bearing to the pilot from his station, and the pilot flies on the reverse of this bearing and ultimately, with a few corrections from the ground operator, arrives over the operator and is informed of this fact; the operator can tell this moment approximately by the fact that the signals become indeterminate, or perhaps by the use of a direction-finder with vertical motion. In the second procedure the pilot holds his course, and the ground operator estimates his shortest distance from his station by the maximum rate of traverse of his signals and a rough knowledge of his ground speed. In either case the pilot, without descending through the clouds, gets his position fairly accurately every 100 miles or so, and carries on in between by means of dead reckoning. He is also, of course, kept informed, by the intermediate and terminal stations, of any serious meteorological change or impending change, either in wind above clouds or in the conditions below the clouds along the route.

"Taking into consideration the argument that the telephone on the aeroplane is a practical necessity for over-cloud flying, it seems to me that some such method as that outlined above will provide the best means of navigation on much frequented routes, principally because it calls for a minimum of apparatus and technical skill in the pilot. All he requires is the ability to use a wireless telephone set and to lay a course for a short flight by dead reckoning. The directional wireless set is in the hands of a specialist, to whom wireless and not flying is the primary fact of life, and who is sitting in comfort in an office on the ground."

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FLYING-BOATS:

The Form and Dimensions of their Hull

BY G. S. BAKER, Member

(*Continued from page 272.*)

10. *Beam.*—In the earlier types considerable attention appears to have been given to the retention of an upright position when at rest. This involved either twin floats or single floats of large beam. Experiments were, therefore, made in the tank in 1915 to determine the effect of beam on propulsion, and later on transverse stability. The first experiments were made on the America type. The general dimensions of the early America type are given in Table III, and the lines in Fig. 2. This type was tried with beams of 8 ft. and 6 ft. with plain V sections to the fore-body as in Fig. 2, and with sections rounded as in the body plan. It was found that the reduction of beam produced only a slight increase in the maximum power required for propulsion.

Similar experiments were made on hulls of the same type as P 5 (Fig. 2), tank models number 223 A, B, and 222, and more recently on other models of this type (models 389, etc.). These results are summarised in Table II. It will be seen that when the beam is narrow for the length, a change in beam produces a fair change in maximum power required to overcome the water resistance; but when the lifting surface is sufficient to give clean running, there is very little to be gained by increase in beam—not sufficient to compensate for the extra weight involved. These maximum powers are required at a speed roughly ·4 the minimum flying speed of the machine, being a little lower with wide beams or large planing surface. When the speed has been accelerated to about ·7 of the flying speed and above, the larger beam is usually somewhat more resistful than a narrow one. The general effect is independent of type of float and of the mode of varying the beam within the limits of tank experiments, and of the minimum flying speed.

TABLE II.—*Variation of Maximum Power with Hull Beam. Machine of 10,000 lbs. Total Displacement*

Models compared.	Beam over chine feet.	Percentage increase in E.H.P. for 1 ft. decrease in beam.	Hull length over all feet.	Remarks.
222 ..	3·5	9·75	41	Two step type.
223 B ..	5·25			
223 B ..	5·25	6·85	41	Two step type.
223 A ..	7·0			
130 E ..	5·36	3·12	46·9	America type with curved sections to bottom.
130 D ..	7·14			
389 A (deep) ..	6·53	2·76	39·0	Two step P 5 type. Beam varied keeping constant rise of chine above keel at all sections.
389 C (deep) ..	9·80			
390 A	7·04	1·45	42	Two step P 5 type. Beam varied keeping slant of all sections constant.
390 C ..	10·56			
150 A ..	8·5	·87	44·6	America type.
147 A ..	10·9			

Model 222 was a distinctly "dirty" model, and created a much worse water disturbance than model 223 B with which it is compared.

11 Flying-boats, even though they are given quite large beams—up to a quarter their length—are unstable transversely, and without wing or wing float support would topple over at rest. Reduction of beam only renders this negative metacentric height a little greater, and puts a little more load on the wing floats. In an ordinary breeze the machine will cant slightly to one side. With a fair negative metacentric height it will remain canted to one side, instead of lolling from one side to the other with any small change in loading, direction of wind or sea. Before reaching high speeds this instability must disappear of itself, or the pilot must be able to eliminate it. Experiments made in the tank have shown that a hull whose breadth was only 2/17 its length, having a negative metacentric height of 2·5 ft., came upright of its own accord when the planing speed had been reached (21 knots) and was stable at higher speeds. The experiments were made on a model 8·5 ft. in length, fitted with air wing surfaces so as to obtain and measure any effect due to the proximity of the air surface to the water surface. The transverse instability was ascertained by measuring the vertical force required at the wing float position to keep the wing tip *just* out of water at a series of speeds. The planing surface of the hull was given convex, concave and straight V transverse sections in different experiments; but shape of section had very little effect on the general result. The presence of the wing caused a slight reduction of the instability, but it was never important, and the hull, without any wing lift, came almost upright at 21 knots of its own accord and with *full load* on it. These results were obtained with forms having a reasonably good planing surface, and warrant the conclusion that beam may be reduced on any hull to the lowest limit for propulsive efficiency, without fear of ill effect on transverse stability. The general result was confirmed by an experiment carried out on an A.D. machine at Southampton This had a negative metacentric height of 1·5 ft. at rest, but came upright—both wing floats off the water—at 25 to 30 knots, in a light breeze.

12. *Number and Position of Steps.*—The main step is required to be more or less under the centre of gravity of the

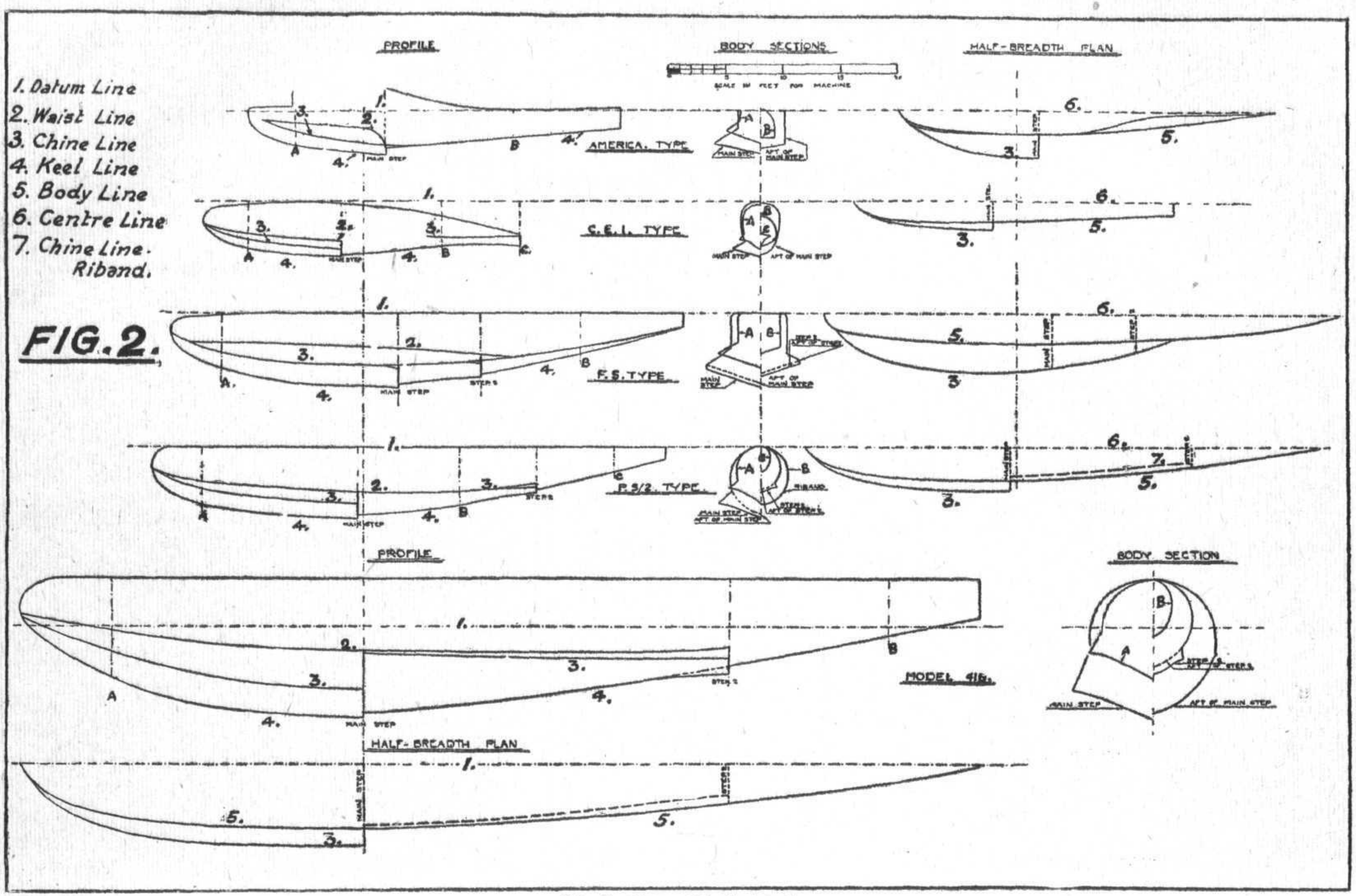

Fig. 2—Lines of typical hulls

machine. Reasonable variations of longitudinal position can be made without serious effect on the resistance, but the change of longitudinal attitude when running may be important—a shift of step aft always reduces the running angle. An experimental machine of 4,600 lbs. total weight, America type, having its only step 4 ft. aft of the centre of gravity of machine, had insufficient elevator control to trim it back for getting off, and this could only be effected by rocking and jumping it off. In some machines in which the step was placed a little before or under the centre of gravity the longitudinal stability on the water has been exceedingly good. The shape of the section at the main step has been referred to in section 7 in connection with settling. Small transverse inclination of section has little effect on the propulsive efficiency, and if the V of the bottom is associated with a flat at the side near the chine, as in the P. 512 and 416 forms, Fig. 2, angles of V up to 130° can be accepted. In plan the step section may be perfectly square to the middle line plane or brought forward towards the sides—it makes little difference to the general result. Air pipes were used in some original hulls for ventilating or supplying air to the step, but have been given up in favour of better shape of hull, as they were always a source of weakness. The depth of the step should increase steadily from the keel to the side of the float and just abaft the step; the hull should be rounded up to give an abrupt break in the form, at the step. This method of ventilation was adopted successfully in the Thornycroft and some other types of "planing" boats, and has been used in many flying-boats.

A second step or something which behaves as, or takes the place of, a second step, is necessary in a flying-boat. Without it the machine cannot be "unstuck." In the original America type the flat under-surface of the tail acted as a second step. When this flat was rounded off, so that it was unable to act as a step, the tail could not be unstuck from the water. A worse result was obtained with an A.D. type machine from which the second step was removed for a trial. The after sections of this hull were oval, and the tail could not act as a step. The machine failed to reach even ordinary taxi speeds, and stalled to a very large angle with tail and tail plane in the water.

Tank experiments have shown that this step need not be wider than 1/2·5 the width of the main step, and that if placed some distance aft the main step, it can be given a deep V shape. This will develop sufficient moment to balance the hull, and any contact between it and the water when getting-off or settling is very gentle, owing to its shape. It should be formed with a chine running practically parallel to the fore body chine at the main step, and should be continued forward almost up to the main step. The tail beyond the second step should be lifted up out of the water, as this keeps the tail air system dry.

If the second step is placed close to the main step, it serves no use except at the moment of settling or getting-off. With the step somewhat further aft it serves to break away the tail and keep it clean, but such forms usually show a tendency to porpoise. When the distance between the two steps is increased to at least 12 ft. with flying speeds of 40 to 50 knots on a hull of 37·5 ft. length, tank experiments have given fairly good propulsive results, and in some cases an absence of all longitudinal oscillation when accelerating. Although it cannot be stated as a general rule, it is believed that a long distance between steps gives better results than a small one.

(To be Concluded.)

Examination for Aviation Ground Engineers

THE Air Ministry announces :—

"Arrangements have been made to hold examinations for candidates desiring to become certified ground engineers (aircraft or engines), under Section 4 of the Air Navigation Directions, 1919, at the following Centres during March and April :—

"London, March 17, March 31, April 14, April 28; Bristol, March 24; Birmingham, March 25; Manchester, March 26; Leeds, April 21; Newcastle, April 22; Glasgow, April 23.

"A candidate may apply to be examined as a ground engineer to overhaul and inspect *all* flying machines and/or engines, or for examination of any named type or types of flying machine or engine.

"The examinations, which may be partly written, partly oral and partly practical will be based on the following syllabi :—

"(*a*) For engines: general principles of internal combustion engines applied to aircraft, including the general principles of ignition, carburation, lubrication and cooling; knowledge of the inspection, testing and adjustments necessary for the installation and functioning of the complete power unit in the aircraft; and the capacity to supervise, or inspect running repairs, and/or overhaul of particular engines.

"(*b*) For Flying Machines: General principles of construction, rigging, trueing-up, and adjustment of flying machines; a detailed knowledge of construction, adjustments, maintenance and final inspection of the flying machine's components; and the capacity to supervise, or inspect running repairs, and/or the overhaul of specified types of flying machines.

"Candidates before examination will be required to show (*a*) that they are not less than 21 years of age, and (*b*) that they have served at least two years as a mechanic or engineer on internal combustion engines or like period on aircraft construction or maintenance, or a period of not less than three years on joint aero engines and aircraft construction or maintenance.

"Candidates desiring to be examined can secure application forms from the Secretary, Air Ministry, London, W.C. 2, and should submit their completed forms of application accompanied by a fee of 5*s*. at least seven days prior to the date on which examination is desired. Candidates should also state at which of the above places they wish to be examined."

Empire Timber Exhibition, 1920

THE Department of Overseas Trade is organising an Exhibition of Timbers grown within the British Empire, to take place at the Holland Park Skating Rink, London, from July 5 to July 17, 1920.

The main object of the exhibition is to bring prominently before those who have to specify timbers in their contracts, as well as the users and consumers of timbers, the full range of Imperial grown timbers and especially those timbers which up to the present are only very slightly, if at all, known in this country. At the same time the Exhibition will demonstrate the chief uses for which such timbers are suitable.

The classification embraces (*a*) Specimens of timber; (*b*) exhibits demonstrating the various uses to which timbers are put; (*c*) wood pulp.

A committee has been formed to arrange all details connected with the Exhibition, and includes representatives of the Colonial Office, Crown Agents for the Colonies, Government of India, self-governing Dominions, Forestry Commission, British societies interested in the production and utilisation of timber.

San Francisco Aircraft Exhibition

THE first national aircraft exposition to be held on the Pacific Coast will be at the Exposition Auditorium, San Francisco, April 21 to 28, inclusive. It will be the third national show of commercial aircraft to be held in the United States this year, and it is anticipated that the aircraft and accessories shown in Chicago in January, and in New York in March, will be on view, supplemented by other craft which could not be assembled in time for those shows.

Lost in the Sahara

IT is now feared that the aeroplane carrying Gen. Laperrine and piloted by Sergt. Bernard, on a flight from Tamaurasset to Timbuctoo, has been lost in the desert, a search organised by the Governor of Dakar having resulted in no trace of the missing machine being found. Gen. Lapperine and Sergt. Bernard left on February 18, with Maj. Vuillemin, who piloted another aeroplane. Maj. Vuillemin arrived alone at Sao, on the Niger, having lost sight of his flying companions before reaching Kidal. It is believed that the aeroplane landed in the open desert to the north-east of Tun-Zaouatem.

New French Air Routes

ON his return by air, from London on March 8, M. Flandin, Under-Secretary for Aeronautics, published a programme for a proposed extension of France's commercial air lines. It is suggested that State subsidies should be granted to French companies employing French pilots and mechanics, and landing places established on air routes, throughout France, to be mapped out by the State Director of Aerial Navigation. The new international routes proposed include :—

Paris-Abbeville (for London); Paris-Tours-Angoulême-Bordeaux-Bayonne (for Spain); Paris-Valenciennes (for Brussels); Paris-Strasbourg (for Central Europe); Paris-Dijon-Lyons-Marseilles-Balearic Islands (for Algiers); and Paris-Nice-Corsica (for Tunis).

A number of cross-country routes are also proposed, including a few in Northern Africa.

SIDE-WINDS

ALTHOUGH the fire which occurred at the works at Willesden in which G.A.C., Ltd., were carrying on their post-War operations as wood-working and constructional engineers, completely gutted the premises and destroyed the mill, with all its machines, the work in all stages of progress, working drawings, etc., Mr. H. Bayley, the manager, with his usual business acumen, at once tackled the problem of "carrying on." The reconstruction and equipment of the old factory, at the best, would have taken many months, and, had the resumption of their business been dependent upon it, the effect would have been very serious. Fortunately, however, the British Aerial Transport Co., Ltd., were on the point of relinquishing that portion of their works which is situated at Willesden, and came to the rescue of the G.A.C. with an offer of the commodious premises, including the mill fully equipped with modern plant, the buildings covering a considerable area of ground and constituting a wood-working factory available for instant occupation and immediate resumption of G.A.C. operations. Within eight days of the fire, the purchase of the works was completed, and occupation was entered into ten days after the outbreak. The effects of the fire will be further minimised by the fact that the capacity of the new works very greatly exceeds that of the old factory, so that considerable expansion of G.A.C. productivity may be looked for. Although conditions in the aircraft industry at the present time have necessarily compelled Messrs. G.A.C., Ltd., to direct their energies outside the aeroplane industry, as pioneers since 1911 they will always be ready to re-arrange their programme to embrace aircraft work whenever there is justification for so doing.

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NEARLY 20,000 entries were made for the Rolls-Royce £1,000 competition, which, as announced in our last issue, was won by Mrs. Alice Waters. The task set was to condense a paragraph, consisting of three sentences, referring to the successes of the Rolls-Royce engine in the Atlantic and Australian flights, to a single sentence, retaining all the facts and wording the suggestion suitably for advertising. The committee of advertising men, who were entrusted by Messrs. Rolls-Royce, Ltd., with the task of adjudication, have had anything but an easy time during the past few weeks.

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HIS many friends in England and Scotland were shocked to hear that Mr. Fred Norman had died of heart failure at Nairobi, British East Africa, on February 1. Mr. Norman, who was one of the pioneers, will be remembered by many for his enthusiastic work as Secretary of the Aquatic Sports at Shepperton a year or so back, which provided substantial aid to the R.A.F. hospitals. He had gone out to East Africa in connection with some extensive building operations.

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WE have received a copy of a letter which has been addressed to the President of the Board of Trade by Mr. H. W. A. Deterding, on behalf of the Shell Royal Dutch Group. The letter reads as follows :—

"I have discussed with those of my colleagues of the Shell Royal Dutch Group who are now in London the published report of the Sub-Committee on petrol prices, and we feel it our duty to place before you the facts as they are known to us.

"On the main issue as to the controlling influence on the price in the United Kingdom of the f.o.b. price of petrol in New York we agree with the report. It is not, however, a fact that we, or any other concern, fix or control this price. In view of the general impression abroad as to the existence of a world-wide petrol ring, we desire to make the statement deliberately and emphatically that no such ring exists. No one is in a position to dictate any reduction to the thousands of oil producers in the United States who sell in the open market in which we buy. These producers try to get the best price they can secure in competition with one another, and we have to pay this price for the very large quantities of American petrol necessary to satisfy the requirements of our clients over and above Eastern production. We cannot, as a matter of fact, buy petrol in the United States at less than £25 at Atlantic ports instead of the £7 10s. suggested by the Committee.

"It is unquestionable that the world-demand for petrol, even at the present time, exceeds the supply, and the great shortage already existing in other European countries is evidence of this fact. We entirely agree with the Committee that every endeavour should be made to foster the production of power alcohol and other motor fuels of all kinds both in the British Empire and throughout the world.

"For the present, so far as we can judge, the only possible remedy for existing high prices is a drastic reduction in the consumption of petrol. This is our opinion, but we desire to state that our group places itself unreservedly at the disposal of the Governments of the chief European countries for consulation as to the position and the steps to be taken."

Lieut.-Col. Loraine's Adventure

WISHING to get home from Switzerland in quick time, Lieut.-Col. Robert Loraine on March 4 left St. Moritz in a Condor machine, piloted by Comte. Unfortunately, owing to heavy mist and low clouds and the use of a very poor map, the pilot lost his way after leaving Zurich and landed at Marburg, in Prussia, where their reception was none too cordial. On the next day another stop was necessary at Elsenborn, and finally the machine reached Antwerp, where as the weather was too bad for flying, Col. Loraine decided to complete his journey to London by boat and train. Col. Loraine says in flying over Germany he was very much impressed by the extreme activity that was everywhere noticeable. At all the manufacturing towns chimneys were belching forth smoke and quarries were being worked very actively.

Nice to London in 9½ hours

A FINE performance was made by the Airco 4 (Rolls-Royce) belonging to Messrs. Instone and Co. on March 4. Leaving Nice at 6.20 a.m. (G.M.T.), the machine, piloted by Mr. F. L. Barnard, with Mr. H. W. Chattaway and Mr. Alfred du Cros as passengers, flew to Lyons in 2 hours 35 mins., the direct route being taken over the Alpes Maritimes. After a stop of about an hour, the machine completed the stage to Paris in 2 hours 25 mins., while the third portion of the journey to London took 2 hours 7 mins., the machine landing at Hounslow at 3.50 p.m. The flying time for the 900 miles was 7 hours 7 mins.

London to Nice in 15½ Hours.

ALTHOUGH there is no regular air service from London to Nice, we understand that by taking advantage of the air lines already in existence something like 12 hours of the most tedious travelling may be saved. The Lep Aerial Travel Bureau of Piccadilly Circus have completed arrangements for this journey.

The journey to Paris is made by Airco aeroplane and from Paris is continued by sleeping car express to Avignon, here the change is again made to the aeroplane—a machine of the Compagnie Aerienne Francaise making the flight from Avignon to Nice in 1½ hours, saving about six hours on this section of the journey alone. Leaving London by this route at 3 p.m. the passengers arrive in Nice before 10 a.m. the next day. The fare, which is subject to the variation of the French exchange, is roughly £34.

A H.P. in Scandinavia

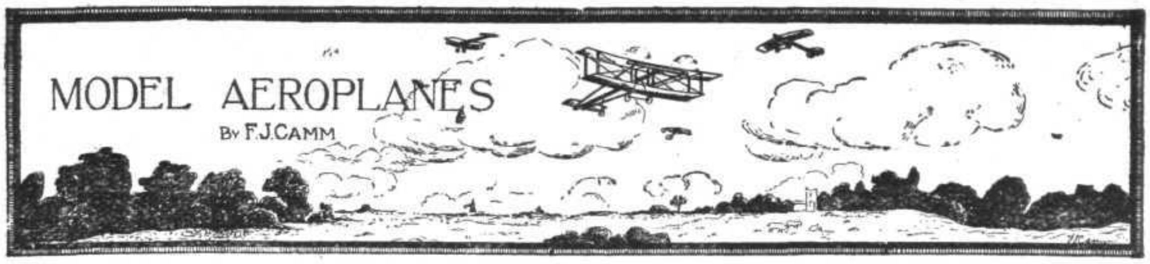
THE Handley-Page aeroplane, piloted by Capt. Stewart and Capt. Gran, which flew from London to Denmark last summer, recently concluded a number of demonstration flights in Scandinavia. The weather conditions met with were somewhat trying for aviation, as the country abounds with mountains and lakes, which filled the atmosphere with "bumps" and cross currents, apart from the difficulties such landscape presented in the event of forced landings.

On one occasion two snow-ploughs had to be utilised to clear the ground before the machine could "take off," and when it did commence to run across the ground the slip stream of the propellers sent great showers of snow 7 ft. high.

The machine gave exhibition flights at Copenhagen, Arrhus and Christiania, where 454 passengers were given flights in the aeroplane, by the inhabitants and the flying officers stationed near Denmark. They were astonished when Capt. Stewart carried out a few mild "stunts"; on landing after a flight during which he mildly pulled the Handley-Page to a very steep climbing angle, he was congratulated on his excellent "loop."

Fast Flying in Italy

FLYING at the Mirafiori aerodrome, Turin, on March 3, with a passenger, Lieut. Brak Papa on his A.R.F. biplane with Fiat motor, attained an officially recorded average speed of 273 kilometres (169½ miles) an hour. The highest speed reached was 277 kilometres (172½ miles). On the following day Lieut. Brak Papa, with two passengers, flew from Turin to Rome, a distance of 623 kilometres, in 2¼ hours, his average speed being 276·888 k.p.h.



NOTE.—*All communications should be addressed to the Model Editor.*

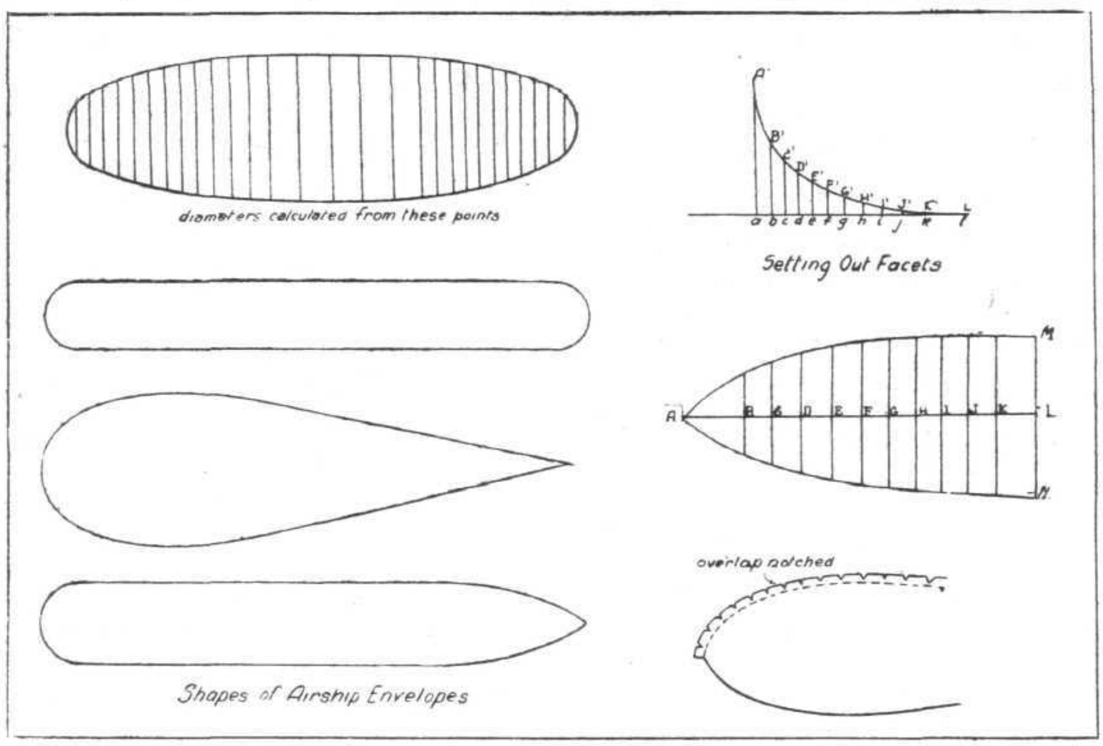
The Design of Model Airships

As a number of enquiries have been received lately regarding the possibilities of making models of airships, the following notes are given :—

The fundamental principle of lighter-than-air craft is the lifting power of hydrogen, which, for model purposes, may be taken as 70 lbs. per 1,000 cub. ft. Coal gas lifts only about 38 lbs. per 1,000 cub. ft. Little success can be expected with small models of airships, owing to the difficulty in working to fine weights. The following calculation (which relates to an airship 3 ft. long and $2\frac{1}{2}$ ins. diameter) shows the extremely fine limits which must be worked to :—

Capacity of airship $= \frac{22}{7} \times \frac{5}{2} \times \frac{5}{2} \times \frac{36}{1} \times \frac{1}{1728}$ and the total weight lifted will be—

$$\frac{22}{7} \times \frac{5}{2} \times \frac{5}{2} \times \frac{1}{1728} \times \frac{70}{1000} = \cdot 028 \text{ lb.}$$



It is extremely doubtful whether a model of the foregoing dimensions could be built to so small a weight. Now, if we double the *length*, and let the same diameter remain, we obviously have double the weight, and also double the lifting capacity = ·058 lb.—still too fine from a practical point of view. But if we *double* the *diameter*, and let the length remain, we have *four* times the lifting capacity for only *twice* the weight, as the following calculation proves :—

$$\frac{22}{7} \times \frac{5}{1} \times \frac{5}{1} \times \frac{36}{1} \times \frac{1}{1728} \times \frac{70}{1000} = \cdot 112 \text{ lb.}$$

This point should be kept well in mind when designing model airships, and the diameter should, therefore, be kept as large as is commensurate with a proportionate length and breadth, and the *diameter* should be varied to obtain more lift—not the length.

It will clearly be understood that a model airship has in reality a higher lift per 1,000 cub. ft. than full-size craft, as owing to the greater quantity of material to be forced out to form the latter it must be necessarily inflated to a greater pressure per square inch, with a corresponding reduction in the lift ; whereas with models a much lower pressure will serve to impart the intended shape to the envelope.

The materials available for model airship work, with their superficial area per lb., are given in the subjoined table, from which it will be apparent that goldbeater's skin is by far the most suitable :—

Goldbeater's skin	.. ..	120 sq. ft. = 1 lb.
Varnished silk ..	.. ..	80 sq. ft. = 1 lb.
Prepared rubber	.. ..	40 sq. ft. = 1 lb.
Varnished cotton	.. ..	25 sq. ft. = 1 lb.

The seams or joints necessary in the material materially increase these figures, and at least 30 per cent. should be allowed for them ; in the case of goldbeater's skin, which cannot be obtained in large pieces, at least 60 per cent. should be allowed.

Shape

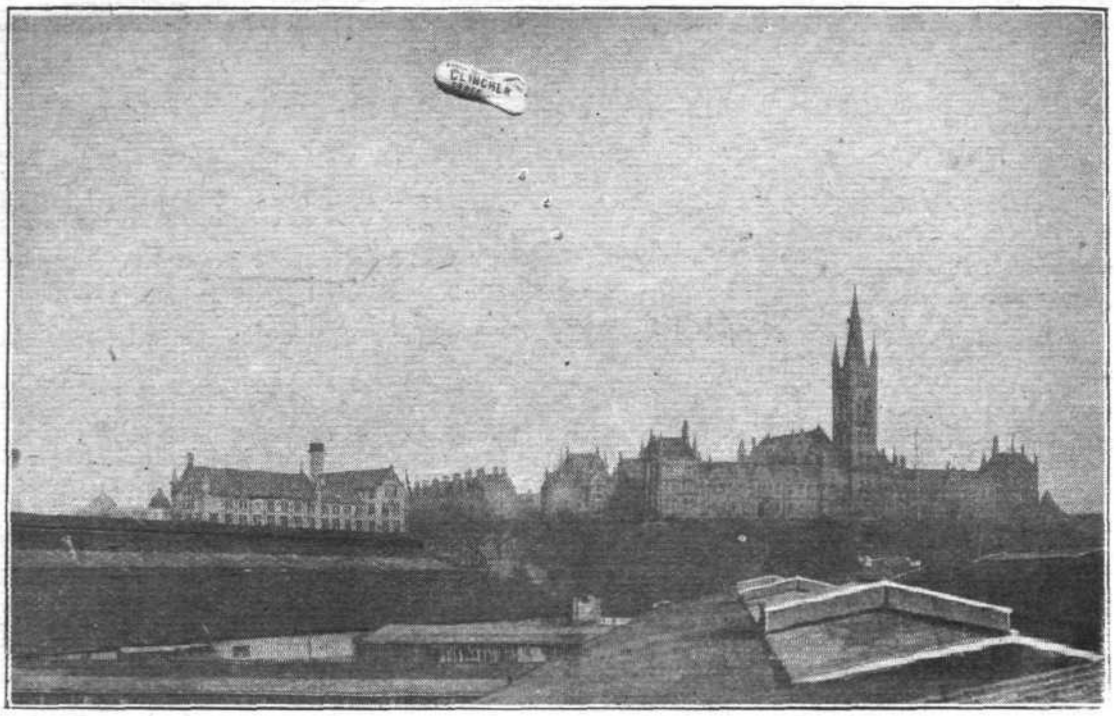
The accompanying illustration shows the various forms (side elevational) imparted to model airships. The usual method of setting out a section of, say, A is to divide the length of the model into a number of parts and calculate the circumference at those points, by multiplying the diameter by $3\frac{1}{7}$. If the envelope is to be made in two portions only, the corresponding dimension of each piece will be half the circumference. Thus, if the length has been divided into 12 parts, a line representing the length of the model is drawn and sub-divided into 12 parts, and half the circumference at those points is plotted equidistant on each side of the centre line.

Setting Out Facets

It will, of course, be apparent that the length of the curve of each facet is actually longer than the length of the hemisphere. For example, if the length of the hemisphere is 12 ins., the length of the facet will be greater than 12 ins., being equal in length to one-fourth of the circumference of the hemisphere. Therefore, the centre line of the facet must not be marked off in lengths equal to the lengths of sections taken ; but in lengths equal to $\frac{1}{4}$ of the circumference of a hemisphere sub-divided into the given sections. First draw a tangent to a quarter circle whose radius is equal to the hemisphere to be constructed, and vertical lines are then erected (at an equal distance apart) which just touch the curve. The lengths of the arc cut by these lines are transferred by the dividers to the centre line of the facet in their proper order.

In the accompanying drawing, the length LK on the centre line of the facet is equal to the L′ K′ on the curve, KJ equals K′ J′, and so on. If there are to be 24 facets, the width of the facet is equal to $\frac{1}{24}$th of the circumference of the hemispherical cap at the corresponding cap. Thus, if the circumference at K′ is 24 ins., the width of the line MN will be 1 in.—$\frac{1}{2}$ in. on each side of the centre line. The circumference at each point is calculated and then divided by the number of facets (the greater the number of the latter, the more accurate the finished shape). In a similar manner, the remainder of the widths are marked off and the outline drawn in with a French curve—not forgetting to allow for the seam. It is a good plan to use a dummy facet in cardboard for marking out. The overlap for the seam should be notched, to allow the fabric to form to its shape ; joints should be made with gold size. Only one overlap is necessary for each facet.

(To be continued)



"Rubber-Necks" is a well-understood term used in America: For initiating the public here into appreciating the meaning of this phrase, the captive air-balloons, of which the North British Rubber Co., of Edinburgh, make a speciality for advertisement purposes, are perhaps the most practical form at present in being. And this by reason that, when watching their balloon (seen above) with its attendant "satellites," which was such a prominent feature over the Kelvin Hall, Glasgow, during the recent Scottish Motor Show, it was impossible to avoid noticing that every man, woman and child just gazed up at the floating object again and again, twisting their necks to watch its gyrations. Yes, they understand the art of attracting up Edinburgh way

COMPANY MATTERS

Harris and Sheldon

THE report of Harris and Sheldon, Ltd., for 1919 states that the profits, after making provision for depreciation, allowance for bad and doubtful debts, reserve for excess profits duty, and providing all management expenses, amount to £31,629, which with £9,501 brought forward makes a total of £41,131. It is proposed to pay final dividend of 6¼ per cent. on ordinary shares, making 10 per cent. for the year, and in addition a bonus of 15 per cent., allocating to contingency reserve £5,000, to reserve £15,000, and carrying forward (subject to settlement of duties under Finance Acts) £9,811.

Anti-Aircraft Incendiary Bullets

THE Royal Commission on Awards to Inventors, Mr. Justice Sargant presiding, on Monday heard claims in respect of incendiary bullets.

Mr. H. Dickenson, the first claimant, stated that he was an engineer who had been experimenting for 30 years, and he claimed to have placed at the disposal of the Admiralty certain ideas which contributed to the invention of the explosive bullet, which ultimately proved successful. In February, 1914, he brought out a bullet which on coming into contact with a specially prepared surface would ignite it. In October, 1914, he was experimenting with an incendiary bullet intended to set fire to Zeppelins. At an Admiralty test the bullet set fire to balloons filled with hydrogen. The Air Department arranged for experiments at Woolwich Arsenal.

Later Mr. Dickenson had a conversation with Commander Brock; although his invention came to nothing, he learned later that Commander Brock had been successful with an explosive bullet, and he formed the idea that his invention had contributed to the success.

Mr. R. Moritz, for the Admiralty, offered to place the secret of Commander Brock's bullet before the Commission in the presence of Mr. L. O'Malley, who would be bound to professional secrecy.

When the Commission resumed in public, Commander Fellowes, formerly officer in charge of the Ordnance Department at the Admiralty, said that between May and August, 1915, Commander Brock told him he had been experimenting with an incendiary bullet. That type was not then considered useful, and he asked Commander Brock if he could give him a type of bullet which would disperse the supposed inert gas around a balloon. Commander Brock sketched his idea, which was used in 1916 and was responsible for the destruction of Zeppelins.

The Commission will consider their decision.

AERONAUTICAL PATENTS PUBLISHED

Abbreviations:—cyl. = cylinder; I.C. = internal combustion; m. = motors

APPLIED FOR IN 1918

The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

Published March 11, 1920.

12,279. G. H. Thomas and E. P. King. Aircraft propellers. (138,656.)
20,906. V. A. F. BELLAMY and A. O. BINDING. Airship engines. (138,661.)
21,321. G. HALLIDAY. Aeroplanes. (138,662.)

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Published March 11, 1920.

582. J. A. SPENCER. Aeroplanes. (138,667.)
2,343. J. J. MAYROW and M. POTICHANOFF. Aerofoils, wings, framework, etc., of aeroplanes. (138,687.)
4,051. STABILIMENTI BIAK-ING. A. POUCHAIN. Sectional bars for aircraft construction. (123,749.)
5,254. W. P. HINES. Inclinometers. (138,725.)
6,966. BLACKBURN AEROPLANE AND MOTOR CO., J. W. COPLEY, and A. C. THORNTON. Maintaining at required temperature the contents of reservoirs, etc., carried by aircraft. (138,746.)
19,645. A. V. ROE. Towing-cables for aeroplanes. (138,821.)
20,553. A. ANZANI. Multi-cylinder I.C. engines. (131,882.)

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All Advertisement Copy and Blocks must be delivered at the Offices of "FLIGHT," 36, Great Queen Street, Kingsway, W.C. 2, not later than 12 o'clock on Saturday in each week for the following week's issue.

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